Rai Chunilal Bose Bahadur, C.I.E., I.S.O., M.B., F.C.S.
Rasayanacharjya.

THE SCIENTIFIC

AND

OTHER PAPERS

OF

RAI CHUNILAL BOSE BAHADUR, C.I.E,
I.S.O., M.B., F.C.S., *Rasayanacharjya.*

VOL II.

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DEDICATED
WITH REVERENT LOVE
TO THE MEMORY OF MY UNCLE
RAI SAHIB AMRITA LAL BOSE

PREFACE.

Owing to unavoidable circumstances, there has been some delay in bringing out the second volume of my father's *Scientific and Other Papers.*

In this volume, the papers have been grouped under the following heads :—

I. Hygiene & Public Health.
II. Temperance.
III. Biographical sketches.
IV. Popular scientific lectures.
V. Miscellaneous, dealing with some important social problems.

Unlike the papers published in the first volume, those contained in this volume will be found free from scientific technicalities, having been written for the benefit of students and general readers. Some of them have an important bearing on the current topics of the day; others deal with matters which are of vital importance to the community at large and the students in particular. It is hoped that the publication of these papers in a collected form will be helpful in keeping alive a healthy interest in subjects of such importance as Public Health, Food Reform, Temperance and Social Service.

CALCUTTA, J. P. BOSE.

The 15th. September, 1925.

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HYGIENE
AND
PUBLIC HEALTH

Necessary Measures for the Prevention of Food-Adulteration.*

In this paper, I propose to consider briefly the present situation as to the supply of pure food and what occur to me as the steps necessary to be taken for the prevention of adulteration of food.

1. **Education of Public Opinion** :—Deceit in trade there ever was and there ever will be. Dishonest men will ply their nefarious business in their own way notwithstanding all restraints of law and the salutary effects of education. But if law and education cannot wholly root out the evil propensities of such men, there is no doubt that they can keep them within due bounds. It seems to me that it is necessary to spread education, and at the same time, apply the restraints of law in order to protect society from being victimised and injured by an unscrupulous section of its members.

* Calcutta Medical Journal, July, 1910.

It is in the nature of certain classes of people to seek for cheap things. The well-known Bengali proverb that "*cheapness is thrice cursed*", though ringing in their ears, they give more thought to the present than to the future. Everybody knows that cheap clothes do not last long, that cheap boots and shoes become useless after a few days' wear, that cheap materials used in the construction of a building can ill-stand the caprices of wind and rain and soon succumb to their ravages. And yet knowing all this and much more, they cannot resist the temptation of cheapness. It is not only that a thing which is full-valued lasts longer, but one derives so much more ease and comfort by its use as he can never expect from the use of a cheaper article. This is true not only in the case of other substances but is decidedly so in matters of food-stuffs. Owing to the prevalent high prices of food-stuffs, cheap food must necessarily be adulterated. The use of such food very often means not economy but the reverse of it. Adulterating materials have mostly an injurious effect on health. In the first place, they diminish the nutritive value of the food; secondly, they impair the vitality of the body by bringing on dyspepsia, dysentery and other kindred diseases. The vitality being thus weakned, one cannot work as well as in health and the earnings accordingly are diminished in proportion. Moreover, the diseases that follow the use of adulterated food have to be treated, and

money is required for that. It becomes thus apparent to any one that the policy of buying cheap and therefore adulterated articles of food is by no means a sound one. It has a deceptive charm for the mind of the buyer for the time being, but in the long run, it becomes a prolific source of suffering, misery and pecuniary loss. Those who have not the means of buying pure ghee would do better to give up its use altogether and take to pure mustard oil in its stead than go on using adulterated ghee.

One's vanity may be satisfied by the use of costly bazar sweetmeats which are invariably prepared with bad ghee, but at what a cost? Nothing less than health deteriorated and money mis-spent. The consumption of these bazar sweetmeats in our homes, even in those of men of very limited means, is on the increase, and yet, do we notice any improvement in the physique of our boys and girls by their use? On the other hand, what one notices in these days of expensive living is a distinct downward tendency in the health and longevity of the average Bengali. This presents a contrast with those good old days when men used to enjoy excellent health and grew strong by taking simple and unadulterated articles of food. But the ways of living are changed. Now a father, however humble his means may be, would think it unbecoming to give his children such simple food as fried rice and molasses but would feel no hesitation in distributing among

his dear children, with his own hand, those balls of poison in the shape of bazar sweetmeats! Such is our vanity and no wonder that it will have its evil effects. If your means do not allow you to take pure milk unmixed with water, why not buy pure milk at a somewhat higher price and water it yourself as much as you please at home? You will thereby at least guard against the milk being contaminated with the germs of such virulent diseases as cholera and typhoid fever, which originate from the reckless conduct of *gowallas* in mixing with the milk any sort of infected water from dirty tanks lying within easy reach.

If men would be inclined to pay, at some temporary sacrifice, a little higher price for the purchase of pure food-articles and use nothing but such stuffs, then in the long run, they would be sure to reap the benefits of their prudent action by securing to themselves sound health, long life and the fruits of real economy. Public opinion has to be educated in this matter, and the sooner it is done, the better for the present and future well-being of society. So long as there is any considerable body of men willing and eager to buy cheap articles of food, there will be disonest tradesmen manufacturing the impure stuff to meet their requirements. Honest men, dealing in pure food only, cannot successfully compete on such unequal terms with their unscrupulous brethren; and thus it happens that pure and unadulterated food is

getting to be a rare commodity in the market, and before long, its very existence will come to an end. The law by itself cannot successfully cope with the evil; for its successful operation, a healthy public opinion has to be created. The first thing, therefore, needed is to educate the people. It becomes the duty of every educated man who has the good of his own society at heart, to lend a helping hand in propagating and fostering a general knowledge of this kind among his less advanced brethren. They should be enlightened as to what ingredients are used as adulterants of the common food-articles, the mischief they produce on the human system, and also what other less costly but pure articles of food could be taken in the place of the more expensive ones with almost equally good effect. Popular lectures should be given on these subjects in a way that the same may reach the masses, and no efforts should be spared to enlist the interest of the public by inviting them to such discourses. In addition, leaflets in simple language should be prepared on the subject and freely circulated among the general public.

Not long ago, a writer in an English Monthly wrote an article on milk in which he shewed that pure milk cannot possibly be had at the price ordinarily paid for it. He has made a comparison of milk, meat and eggs as regards their nourishing and heat-producing power and has clearly shown that, for the same cost, we get more nutritive and energy-producing substances

from milk than from either meat or eggs; and yet milk is expected to be cheaper than the other two commodities. He maintains that if people could only be brought to undertsand that by giving a little higher price for pure milk, they will not in reality be losers, then no one will grudge the comparative high price of this article of food; for the materials that are available in milk for the growth and nourishment of the child's body (without which his bones and muscles do not get strong and properly formed) cannot be obtained in equal proportion from any other article of food of equal value. A nation grows weak when its children become weak in health, and thus the whole question of the health and strength of a nation depends on the use of pure milk. These facts have to be impressed on our people as well. When it was possible to keep milch-cows at less cost and less inconvenience, milk could be had cheaper. Now owing to the high prices of cattle-food and for various other reasons, the rearing and keeping of milch-cows has become very expensive; and it is now idle to expect to get good milk at a cheap rate. But milk is so very indispensable to us, that in the long run, we shall not have to regret the little high price that has to be paid for it.

If there is an offer of a higher price all round for the milk, a better class of men may take to starting good dairies, and it is expected that they can successfully adopt the necessary measures for

the improvement of the breed and health of the cattle and for an adequate supply of pure milk.

II. **Legislation.**—The next important measure for preventing the pernicious practice of adulteration is by means of legislation. In every civilized society, special legislation has to be made from time to time to check the evil. In our Province, the Calcutta Municipal Act and the Bengal Municipal Act provide for the punishment of offences relating to the adulteration of food and drugs. We propose to examine if these Acts are sufficiently comprehensive to meet all contingencies and to see where the defects lie and how they are to be remedied.

I have talked on this matter with some experienced Municipal Commissioners of Calcutta and they all think that the present law does not go far enough, and that it requires amendment and recasting. They say that if the seller openly declares that the food he sells is adulterated, the present law is powerless to restrain his action. It is for this reason that we see proprietors of oil-mills openly advertising the sale of "adulterated mustard oil", and the *gowallas* disposing of their watered stuff described as such. The present law, they maintain, cannot adequately grapple with the contingencies that have thus arisen. Of course, if it can be proved that the adulterated food is injurious to health and unfit for human consumption, the law will bring the vendor of such food to book and punish him adequately. Whether any particular food-stuff

thus admixtured is unwholesome or not, depends on the report of the Health Officer. But in such matters, a great difference of opinion may exist and under the circumstances, the law fails to provide a remedy. Ghee, for example, is often adulterated with other animal fats. No Hindu would like to take lard with ghee and yet it is difficult to get satisfactory evidence that it is injurious to health, for we see people of many countries freely using lard in the place of butter and ghee and they are none the worse for it. Unless and until it is conclusively proved that when ghee is mixed with lard, it has positive injurious effect upon health, the vendor is at liberty to carry on his trade in adulterated ghee, if only he declares the true character of his commodity, and thereby he escapes the grip of the law.

I quote below a few sections of the Calcutta Municipal Act bearing on the sale of adulterated food and drugs :—

Section 502. Chairman to provide for inspection of articles exposed for sale for human food or medicine.—It shall be the duty of the Chairman to make provision for the constant and vigilant inspection of animals, carcasses, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, milk, ghee, butter, oil, and any other article exposed or hawked about for sale or deposited in, or brought to, any place for the purpose of sale, or of preparation for sale, and intended for human food or for medicine, the proof that the same was not exposed or hawked about or deposited or brought for any such purpose, or was not intended for human food or for medicine, resting with the party charged.

Section 503. (1) Power to seize articles etc., which are unwholesome, etc.—The Chairman may, at all reasonable times,

inspect and examine any such animal or article as aforesaid and any utensil or vessel used for preparing, manufacturing, or containing any such article.

(2) If any such animal appears to the Chairman to be diseased or if any such article appears to him to be *diseased, unsound, unwholesome*, or *unfit for human food* or medicine, as the case may be, or *to be adulterated*, or *to be not what it is represented to be*, or if any such utensil or vessel is of such kind or in such state as to render any article prepared, manufactured or contained therein unwholesome or unfit for human food or for medicine, as the case may be, he may seize and carry away such animal, article, utensil, or vessel, in order that the same may be dealt with as hereinafter provided.

Section 504. (1) Destruction of articles seized under Section 503.—When any article of human food is seized under Section 503, it may, with the consent of the owner or the person in whose possession it was found, be forthwith destroyed in such manner as to prevent its being used for human food or again exposed for sale, or, if such consent be not obtained, then if any such article is of a perishable nature and is in the opinion of the Chairman, the Health Officer, an Assistant Health Officer or any Commissioner, diseased, unsound, unwholesome, or unfit for human food, it may be destroyed as aforesaid.

(2) The expenses incurred in destroying any article in pursuance of Sub-Section (1) shall be paid by the person in whose possession such article was at the time of its seizure.

Section 505. (1) Taking before Magistrate animals and articles seized under section 503.—Every animal, article, utensil and vessel seized under Section 503, which is not destroyed in pursuance of Section 504, shall forthwith be taken before a Magistrate.

(2) If it appears to the Magistrate that any such animal is diseased or that any such article is *unsound, unwholesome, or unfit for human food* or for medicine, as the case may be, or *is adulterated*, or *is not what it is represented to be*, or in such state as aforesaid, he shall cause the same—

(*a*) to be forfeited to the Corporation, or,

(*b*) to be destroyed, at the charge of the person in whose possession it was at the time of its seizure, in such manner as to

prevent the same being again exposed or hawked about for sale or used for human food or for the preparation or manufacture of or for containing any such article as aforesaid.

On reading the above sections, it seems to me quite plain that large and extensive powers have been vested in the Chairman, the Magistrate and the Commissioners for the destruction of all articles of food that are either *injurious to health* or *adulterated*. I am not of the same opinion as those who hold that the present law is inadequate for the prevention of adulteration of food; but this does not mean that I do not consider amendment necessary. Though not a lawyer, I have tried to show in this paper what appears to me to be the shortcomings and defects of the present law and I have suggested measures for the remedying of them. *

Under the present law, the Chairman of the Corporation or the Health Officer or the Assistant Health Officer or a Commissioner may order the destruction of all unwholesome articles of food of a perishable nature, such as fish, meat, milk &c., (Section 502). It is owing to the exercise of this power that we see a certain quantity of adulterated milk, putrid fish etc., being daily destroyed in the metropolis; but the quantity of these unwholesome food-articles which are so detected and

* Both the Calcutta and the Bengal Municipal Acts have since been amended and many of the suggestions contained in this paper have been accepted. EDITOR.

destroyed bears no proportion to the quantity which eventually passes to the consumer. The Health Department should employ a much larger number of officers for inspection-work in all parts of the town where food-articles are manufactured and sold. If the visits of the Inspectors are frequently repeated to these places, a larger quantity of unwholesome food is certain to be destroyed daily and we may then expect a more effective check on the mischief.

As regards an article of food like ghee or mustard oil which is not of a perishable nature, if any suspicion exists regaring its quality, the Chairman shall order it to be produced before the Magistrate. It shall then be sent for examination and if it proves to be *unwholesome* or *adulterated* or *not what it is represented to be*, the Court shall order it to be forfeited to the Corporation or destroyed at the cost of the vendor (Section 505).

Thus it appears that there are suitable provisions in the present law for the destruction of either *unwholesome* or *adulterated food*, and it is only necesssary that the law should be applied with vigour. If the destruction authorised by the law is rigorously carried out by the Municipal Officers for a few months, the stock of the adulterated food-articles in the bazars of Calcutta will soon dwindle down into an insignificant nothing and few traders

would dare replenish their stock of impure stuff at such heavy risk.

Perhaps the Executive of the Calcutta Corporation hold the same view as the Commissioners above referred to in thinking that if food is adulterated and sold as such, but not proved to be unwholesome, no action can be taken under section 505 for its forfeiture and destruction, and hence the enforcement of this section, so far as we know, has not hitherto been insisted upon. On reading the law as it stands, it appears to me to be sufficiently plain that such food-stuffs, whether injurious to health or not, could be dealt with in the same way as unwholesome food. So long as the present section remains in force, the destruction of adulturated food under the Act seems to me justifiable.

In some recent cases of offences against the provisions of this Act tried by the Municipal Magistrate of Calcutta, the administration of the law as worked by him is expected to deal a severe blow to this evil practice. The Magistrate rightly held that when a buyer asks for ghee and the vendor supplies him with adulterated ghee, he is punishable under the law. According to him, ghee must be the pure article and not in any way adulterated. We quote below the judgment of the learned Municipal Magistrate for the information of our readers. He lays down in his judgment that the vendor is bound to

supply the article asked for in the pure condition and that it must in no way be adulterated. Nobody says to the vendor in so many words, "give me adulterated ghee", and yet the present state of things is such that one seldom gets the pure stuff he asks for.

"This was a case under Section 574-495 of Act III (B. C.) of 1899, and the facts appear from the Magistrate's judgment :— The accused Janaki Nath Kundu, a shop-keeper in Sir Stuart Hogg Market (No. 24) sold an article (ghee adulterated with 10 per cent. of foreign fat) to the Food Inspector Dr. Lahiri, *which was not of the nature, quality, or substance of the article demanded, i.e., ghee—which means pure, unadulerated ghee.* The accused is, therefore, guilty under Sections 495 and 574 of the Calcutta Municipal Act. The accused sells in Sir Stuart Hogg Market and ought to be careful about the quality and nature of the article he supplies to his customers. He is sentenced to pay a fine of Rs. 60 only as this is his first offence and as he is neither an importer nor manufacturer of ghee, the article sold by him in this case." *Indian Daily News, 9th June, 1910.*

I have already said that if there are more frequent inspections of the places in which food is sold or manufactured, we would expect to see much better results. We have read with interest the reports of a good many Municipal prosecutions in such matters published in the Indian daily News of the 13th and 21st June last. If the Municipality is alert and vigilant, it is confidently expected that even the present law will in a great measure stop the sale of adulterated food. By regularly publishing reports of these cases, the Indian Daily News is doing a real service to the community.

It has already been stated that it is the contention of some of the Commissioners that the present law cannot touch the vendor who sells adulterated food-stuff under a proper declaration, unless such article is proved to be unwholesome; and taking advantage of this loophole and the ignerance of the customers, enormous quantities of impure food-articles are daily being sold in the bazars with impunity. In their opinion, this is the grave defect of the present law for which the Act requires amendment to provide for the adequate punishment of such vendors. It seems to me that in such cases, the buyers are more often open to blame then the vendors. If one prefers buying the adulterated article because it is cheap even when he could get the pure thing, the fault lies with him and not with the vendor. No law can, under such circumstances, protect him from the evil consequences of the use of adulterated food. Suppose, for instance, that there are two different kinds of mustard oil in a shop. The first sells at Rs. 14 - a maund and the other at Rs. 18/-. If knowing all this, I prefer to buy oil at Rs. 14 - a maund (because it is cheaper), how can I exect to get the pure article? And how would it do to call the vendor a cheat and subject him to prosecution? Of course, if I pay for the pure article which turns out on analysis to be adulterated, then only is the vendor really guilty and should

be heavily punished, and the law has ample provision for this. Thus we see that more often it is the buyer who encourages the sale of adulterated articles of food. The matter for regret is that we find a large number of customers for the adulterated food among the educated classes who ought to know better. There is excuse for the ignorant people showing a greater preference for cheap things; but we have already shown that the use of cheap food is neither conducive to real economy nor beneficial to health.

If an article of food is proved to be unwholesome, it is liable to be instantly destroyed and thus the vendor is punished. But as regards the unwholesomeness of some adulterated food, a great divergence of opinion exists and it thus becomes difficult for the Court to come to a right decision. But in spite of this difference of opinion, common sense and local conditions ought to help us a great deal in deciding whether a particular adulterated food-stuff is or is not injurious to health. Digestion of food depends greatly on our habits of life and none will deny that the mind has a great influence on the physiological process. If the mind gets prejudiced against a particular kind of food, it becomes increasingly difficult for the same to be easily digested. The Hindu has a strong aversion to any kind of animal fat except ghee. Though it is a fact that ghee and other animal fats belong to the same class

of food, no Hindu would like to take ghee that has been admixtured with such fat. If he takes it, we are perhaps right in thinking that his prejudice will injuriously affect his digestion. Besides, there is a great difference between ghee and other animal fats as regards their chemical composition. Though they belong to the same class of food, there is want of evidence to show that both are equally digestible. On the contrary, the difference in their chemical composition rather points to the other way.* Therefore, it seems to me not at all inconsistent to hold that ghee that has been adulterated with other animal fat is injurious to the health of the Hindus. There is no reason to suppose that other animal fats will agree with the stomach of the prejudiced Hindu, simply because other people are seen to live and thrive upon them. I shall explain myself by an example. The people of Burmah are fond of eating a large quantity of a kind of stinking putrid fish which they call "Gnapee." Just as we have our dishes cooked with various kinds of spices, the Burmese add *gnapee* to every dish of theirs and relish it immensely. They live and thrive well on such disagreeable stuff.

* High authorities on dietetics hold that butter is more easily digestible than other animal fats. According to Hutchinson, the lower the melting point of the fat, the more completely is it absorbed, and that in its turn implies that it is easily digested and absorbed. As a matter of fact, butter is the most easily digested of all fatty foods. The melting point of butter is 37°C, that of bacon is 48°C., while the melting point of mutton-fat is 52°C. EDITOR.

But how would it do to add *gnapee* to the food of a European or an Indian? Surely such admixture would upset his digestion. Therefore, it is quite reasonable to hold that *gnapee*, though not an unwholesome food for the Burmese, is positively injurious to other people. To me it appears that the wholesomeness or otherwise of a particular food-stuff ought to be determined not only by an examination of its physical and chemical characters, but also of the local conditions and of the habits of the people consuming it. The poorest classes of people in Behar use Mohua oil as food in the place of the more costly *ghee* and mustard oil, but this should not be the ground for supposing that when Mohua oil is present in ghee as an adulterant, it is equally innocuous and inoffensive to the Bengalis also. Just as it is sometimes difficult to get any direct proof that a particular adulterant when mixed with food is unwholesome, it is likewise presumptuous to assert that it is not so. In such cases, the proper course would be to judge of the wholesomeness of the food by a general examination of its quality aided by a referance to local conditions.

If it is found necessary to change the law, it should be so amended that nothing but the pure article of food should be offered for sale in the market. If this is possible, we may expect to see the sale of adulterated food stopped

once for all. It may appear to some that if only pure food is sold in the market, the poorer section of the community will find it hard to get the required quantity on account of its high price. A little consideration, however, will show that there is no cause for alarm on this ground. If, instead of buying the adulterated food at the price we are prepared to pay for it, we purchase a smaller quantity of the pure article and increase its bulk by the addition of some other innocent edible article of the same class but of less value, not only have we to pay less but we do not run the risk of contracting disease that may follow the consumption of unwholesome food. An example will make my statement clear. Suppose a man requires 12 seers of milk daily for the use of his family but his means do not allow him to have all that quantity of milk in its pure condition. He buys milk at 8 seers per rupee. Now, we have had frequent occasions to examine the 8-seers-a-rupee-milk of Calcutta and have found it to consist of one part of milk and two parts of water. So this man gets only 4 seers of pure milk in all that quantity, for which he pays one rupee and eight annas. Now pure milk sells at Calcutta at 4 seers in the rupee; and so if our friend buys only 4 seers of pure milk and make it up to 12 seers by diluting it with tap-water in his own house, he will be a distinct gainer; for he will then have to pay only a rupee instead of a rupee and a half; and

not only this but he will protect himself and his family from the danger of imbibing the germs of such deadly diseases as cholera and typhoid fever which are likely to be present in the water added to the milk by the irresponsible *gowalas*.

What has been said of milk is equally applicable to *ghee*, mustard oil and other articles of food. Instead of buying *ghee* adulterated with ground-nut oil from the bazar, the purposes of economy and health will both be served by getting a smaller quantity of pure *ghee* and mixing it at home with any kind of edible oil, such as mustard oil. We have no objection to mutton fat, ground-nut oil, mohua oil and other adulterants of food being freely sold in the market as such. Any person so disposed may buy them and mix them with *ghee* or mustard oil, or may even use them in their place. But the law should make it compulsory that only the pure article should be sold in the market; it should prohibit the sale of any article of food that has been adulterated. It is likely that such a law would produce a little confusion and inconvenience in the beginning, but with the spread of knowledge and the lapse of time, its good effect will be brought home to the public and its presence will be welcomed.

If, however, it is found impracticable to enforce a law of this kind, my next submission is that we should have a law in this country similar to that which exists in England for the sale of butter. Just as we generally

use ghee, so the English people use butter in large quantity. Now, dishonest tradesmen began to cheat people by adulterating butter with a kind of fat called Margarine, until a time came when Margarine nearly displaced all butter from the market. To prevent this wholesale swindling, an Act was passed in England called the "Margarine Act." By this act, only pure butter could be sold as such in the market. Butter, however slightly adulterated with margarine, could no longer go by the name of "butter" but had to be called "margarine" instead. I quote below a few sections of the act for the information of my readers:

MARGARINE ACT, 1887.

"Whereas it is expedient that further provision should be made for protecting the public against the sale as butter of substances made in imitation of butter, *as well as butter mixed with any such substances.*

° ° ° ° ° °

Section 3.—The word "butter" shall mean the substance usually known as butter, made exclusively from cream or milk, with or without salt or other preservatives, and with or without the addition of coloring matter.

The word "Margarine" shall mean all substances, whether compound or otherwise, prepared in imitation of butter, *and whether mixed with butter or not*, and *no such substance shall be lawfully sold, except under the name of margarine*, and under the conditions set forth in this Act.

This is a very just and well-considered law. That which is butter and nothing else but butter ought to be sold as such. Lest any ignorant buyer be duped, the English law does not allow the sale of adulterated butter even as "mixed

butter." Unless it is absolutely pure, the name "butter" cannot be used under the law.

We stand in great need of a similar law in this country. Let only pure *ghee* be sold as *ghee*, and pure mustard oil as mustard oil in the market. Let the adulterated articles go by any name, say by that of the adulterants, as enforced by the English law, but not by the name of the pure article. If we call the adulterated mustard oil "mixed mustard oil," the term will not convey a right understanding of its composition. It generally gives the impression that its quality is only slightly inferior to that of the absolutely pure article, but it by no means gives any idea of its being mixed with stuffs which are never used for human food. If the impure food is sold in the bazar under the name of the true adulterant, few people would be inclined to buy it even when they find it cheap. It is, therefore, to be urged that, as in England, the law should make provision for the sale of pure articles only by their proper and true names and descriptions.*

There is yet another law in England by which all Margarine manufactured in England or imported into it from abroad has to be "duly consigned as Margarine" when they are forwarded by any public conveyance. If it is consigned as butter and there arises a suspicion concerning its purity, it will be sent to the Public Analyst for examination; and if it is

* We are glad to note that this wholesome provision has been incorporated in the Amended Acts. EDITOR.

found to be adulterated, then the manufacturer or the importer as the case may be, will be liable to punishment. A law of this kind is likely to help immensely the prevention of the sale of adulterated food in Calcutta by imposing a substantial check on its free importation from the muffusil. If, for instance, those who send ghee to Calcutta for sale are by law compelled to send along with it a declaration as regards the true quality of the article, then the consignee would know what kind of stuff he is importing and the buyers too, with their eyes open, would take either the pure or the adulterated commodity as they liked. It also becomes easy for the authorities, in case of suspicion, to have such goods examined in order to ascertain whether they tally with the description or not, and deal with them accordingly. Thus all parties concerned will be safeguarded if this particular provision of the English law is enforced in this country. I quote below the English law on this subject:—

Section 8 :—All margarine imported to the United Kingdom of Great Britain and Ireland, and all margarine, whether imported or manufactured within the United Kingdom of Great Britain and Ireland, shall whenever forwarded by any public conveyance, *be duly consigned as margarine :* and it shall be lawful for any officer of Her Majesty's Customs or Inland Revenue, or any medical officer of Health, inspector of nuisance, or police constable, authorised under Section thirteen of the sale of "Food and Drugs Act, 1875," to procure samples for analysis if he shall have reason to believe that the provisions of this Act are infringed on this behalf, to examine and take samples from any package and ascertain, if necessary, by submitting the same to be analysed, whether an offence against this Act has been committed."

As regards the sale of butter, the English law provides for yet another safeguard against deception. All vessels which contain butter or margarine for sale have to be duly labelled in bold letters for the information of customers. If margarine is mixed with butter, then the label should bear the word "Margarine" only in big letters. If butter is written instead and it is proved by analysis to contain Margarine in ever so small a quantity, the vendor is punished heavily. This has proved a useful law and a similar provision may with advantage be made in this country. It will give the buyer the facility of getting the thing he requires. Any trick in the matter of vending with false description brings the seller into the clutches of the law. Moreover, the seller will find it no gain in resorting to a fraud of this kind. If the case was that he could not sell any food-article except what was pure, then it might be said that owing to the high price of pure food, he would lose much of his custom and thus suffer a loss; but this is not so. All that the law insists on is that he must fix a label on his goods giving the correct description so as to prevent the public from being imposed upon. Such a law will protect the buyer from being cheated and the vendor from being punished for the malpractice of his supplier. It may appear to some that a law of this kind is only suitable for a place like England where most people can read

and write but not for this country where the mass of people is illiterate. Such an argument would have been admissible fifty years ago but not now, when, owing to the increasing spread of education, the generality of the people are able to make out the class of goods exposed for sale. These considerations lead me to think that a law on the principle above described is likely to prove useful in securing the necessary safeguard.

The English law on the sale of Margarine is quoted below :—

Sec. 6.—"Every person dealing in Margarine in the manner described in the preceeding section shall conform to the following regulations :—

"Every package, whether open or closed and containing margarine, shall be branded or durably marked "Margarine" on the top, bottom, and sides, in printed capital letters, not less than three quarters of an inch square ; and if such Margarine be exposed for sale by retail, there shall be attached to each parcel thereof so exposed, and in such manner as to be clearly visible to the purchaser, a label marked in printed capital letters not less than one and a half inches square, "Margarine" ; and every person selling Margarine by retail, save in a package duly branded or durably marked as aforesaid, shall in every case deliver the same to the purchaser in (or with) a paper wrapper, on which shall be printed in capital letters, not less than a quarter of an inch square, "Margarine".

If we look more closely into the working of the Calcutta Municipal Act, one or two things seem to call for rectification. As the law stands at present, in many cases, it punishes the vendor who has taken no part in the act of adulteration. If one knowingly sells adulterated ghee as pure in Calcutta, he suffers the penalty of the law and no one will deny

that this is quite just and proper. But the fact is that large consignments of adulterated ghee come to the metropolis from outside. Many shopkeepers sell ghee as they get it from the muffusil, they do not adulterate it themselves and they have no means of knowing that the ghee which they sell contains any adulterant. But the law makes no allowance on this account. It is these people who are punished, while the real culprits cannot be got hold of, because the Calcutta Act does not extend its operations to the muffussil. I quote below the section of the Calcutta Municipal Act on this point :—

Chapter 35, Section 495, Clause 2.—"In any prosecution under this Section, it shall be no defence to allege that the vendor or manufacturer was ignorant of the nature, substance, or quality of the article sold or manufactured by him, or that the purchaser, having bought only for analysis, was not prejudiced by the sale."

Even those who administer the law admit of its imperfection in this respect. Let us now see how the English law has provided for cases of this kind. In England, it is only when a vendor knowingly sells an adulterated article as pure that he is punished ; if he can give satisfactory proof that he thought it to be pure when he himself purchased it and that he sold it in the same condition as he bought it and that he had no means of knowing that it was adulterated, he is then let off. A similar law in this country will mete out justice and save the innocent. The English law on the sale of Margarine is quoted below :—

"*Section 7.*—Every person dealing with, selling or offering for sale, or having in his possession for the purpose of the sale, any quantity of Margari ne contrary to the provisions of this Act, shall be liable to convicti on for an offence against this Act, *unless he shows to the satisfaction of the Court before whom he is charged that he purchased the article in question as butter and with a written warrant or invoice to that effect, that he had no reason to believe at the time when he sold it that the article was other than butter, and that he sold it in the same state as when he purchased it, and in such case he shall be discharged from the prosecution* but shall be liable to pay the cost incurred by the prosecutor unless he shall have given due notice to him that he will rely upon the above evidence.

Another provision of the Calcutta Municipal Act that bears harshly on the innocent vendor is that his commodity (when found adulterated) is destroyed and he is saddled with the cost of such destruction. This seems to work doubly hard on the innocent and such a state of things ought to be remedied. We find that in England, such costs are borne by the authorities. Of course, in the case of a vendor knowingly selling an impure article as pure, it would be quite fair to make him pay the cost of destruction.

III. *Other Measures* :—In his pamphlet on "Food Adulteration in Calcutta", Dr. Sasi Bhusan Ghose, M.B., 2nd Analyst to the Calcutta Corporation, has expressed himself in favour of one or two provisions of the English law finding their place in the statute-book of the country. In the present situation, it is not possible to have these provisions enforced in all parts of the country; but where there are Municipalities, these may be introduced with good effect. One of these

is that all manufactories of food-stuffs should be registered. It is frequently seen that it is just in these places that great preparations are made for the adulteration of food. If such places are registered, the officers of the Health Department can frequently inspect them and keep an eye on the purity of the manufactured articles. So far as the supply of milk is concerned, the registration of the places from which it is obtained would bring them under the control of the Municipality for frequent inspection by its officers and for the enforcement of necessary measures against infection and adulteration. The same remarks apply with equal force in the case of *ghee* and other articles of food. Unless all these places are duly registered, it would not be possible for the authorities to spot them out readily and bring them under their control. The English law on this subject is quoted below :—

Section 9.—Every manufactory of Margarine within the United Kingdom of Great Britain and Ireland shall be registered by the owner or occupier thereof with the local authority from time to time in such manner as the Local Government Boards of England and Ireland and the Secretary for Scotland respectively direct, and every such owner or occupier carrying on such manufacture in a manufactory not duly registered shall be guilty of offence under the Act.

The law should also prohibit all adulterants being stored in places where articles of food are manufactured. If an adulterant is found in such a place, it is to be presumed that it is there for admixture with the pure food ; it should be at once destroyed and the offender punished.*

* This has been provided for in the Amended Act. EDITOR.

However successfully we may suppose the Calcutta Municipal Act to work, it is idle to believe that it alone can effectually stop the sale of adulterated food-stuffs in Calcutta. For this, the law should be enforced with equal vigour both in the metropolis and in the muffussil. I am of opinion that it would much improve matters if instead of separate Acts for Calcutta and the Muffussil, we had only one Act for the whole country as is the case in England. It is as absolutely necessary that provisions should be made for the inspection of the places where food-stuff is manufactured in the muffussil as in the metropolis. At present, there is no adequate provision for this and hence it is that so few adulterated articles of food are seized and sent to Calcutta for analysis. If every muffussil municipality employed a Health officer of its own, not only would the health of the area under its jurisdiction be improved but the manufactories of food-stuffs would receive the constant attention of the health officer and an effective check on the evil would thus be imposed. The Chemical Examiner is now responsible for the analysis of the few samples of food-stuffs sent from the muffussil ; when a larger number of samples are sent as the result of frequent inspection by the health officers, the Government will have to employ one or more competent assistants to help the Chemical Examiner to carry on this work. It should not be costly for a

muffussil municipality to have a health officer of its own. We have a large number of qualified men passing annually out of the Calcutta Medical College and the Campbell Medical School ; if they are allowed the privilege of private practice, good men may be had to fill the posts of health officers on moderate pay. It will be necessary to hold a public examination in sanitary science as a test of qualifications for employment as health officer.

There ought to be a "Board of Analysts" in Calcutta whose duty should be to determine the minimum standard of purity of all articles of food. Some samples of milk, for example, are naturally rich, others are found somewhat poor in the proportion of their ingredients ; but both are pure milk in the strictest sense of the term. It would not do therefore, to fix the standard on the results of analysis of the richer samples. For similar reasons, all samples of pure ghee do not yield the same results on analysis. On a consideration of all these points, it is very necessary that the minimum standard of purity of an article of good in this country should be determined and fixed. The above Board should be composed of experts in analytical chemistry who should fix the standards after careful analysis of a large number of samples obtained under different conditions. At present, the purity or otherwise of articles of food in this country is determined on the standard

fixed by the Board of Analysts in England, but, for various reasons, the English standard does not appear to be suitable for this country in all cases.* For instance, the English standard of purity of milk and butter is based on the analysis of cow's milk and cow's butter, but we have to deal in this country with buffalo milk and buffalo butter as well, which are practically unknown in England and which differ considerably in the proportion of their ingredients from those obtained from the cow. It would be utterly wrong to apply the English standard of purity to Indian buffalo milk and buffalo ghee. Unless the minimum standard of purity is determined and fixed for this country by a properly-constituted board of experts, each analyst will try to uphold his own standard in a Court of Justice and thus hamper the impartial administration of the law.

My last word is that all honest tradesmen should combine and establish a Trader's Combination amongst themselves. They should bind themselves by oath not to deal in adulterated food; and if any one among them is found to violate this oath, he should forthwith be removed from the Combination and his name proclaimed and sent up to the authorities for their information. This will prove an effective check against the importation and sale of adulterated foodstuffs. I am told that a number of leading

* In the Amended Acts, standards of purity for articles of food used in this country have been prescribed. EDITOR.

Marwari ghee merchants of Barabazar have formed a Combination of this kind and they do not import anything but good ghee. I am informed that the work of the Combination is going on satisfactorily and they have been able to secure the confidence of the authorities as well.

I shall conclude my paper by making a passing reference to the present situation of Dairy-farming in Bengal. So far as we know, the industry is not in a flourishing condition. For the successful working of a dairy, experience and special training in the business and sufficient capital are needed. The few dairies that have recently been started in this part of the country are suffering from a lack of these essential conditions of success, and the results are accordingly disappointing. In the present industrial state of the country, it seems to me that the help of the Government and of the Municipalities is necessary for the successful working of dairies started by private enterprise. Facilities should be given for the acquisition of lands for pasturage and other dairy-purposes, and loans should be advanced at a moderate rate of interest to back private capital. This matter was fully discussed at the Cattle Conference held at Naini Tal in August, 1909. The Conference made certain recommendations for improving the supply of milk, butter and ghee in the United Provinces and submitted them for the consideration of the Local Government. We have seen in a recent issue of the Pioneer a reference to the findings

of the Conference and the Government resolution on the subject. One of the recommendations of the Conference was that Municipalities should provide for pasturage-facilities out of their funds. Another recommendation was that railways should give favourable rates and special facilities for the transport of milk, the present rates being prohibitive for the traffic. The Conference further recommended that Government should give *tacavi loans* to start dairies managed on modern principles. The Lieutenant-Governor of the United Provinces, in reviewing the recommendations of the Conference, says that he sees no harm in Municipal boards providing general grazing grounds where such grounds are not readily available, but for which fees should be charged. His Honour has also promised to approach the Railway Board with the object of obtaining concessions for the carriage of milk. As regards the granting of *tacavi* loans, the Lieutenant-Governor does not favour this course for the present. His Honour believes that if public-spirited members of the large cities are earnest, there should be no difficulty in raising by private enterprise sufficient capital to equip a modern dairy; but if the capital is not forthcoming by this method, Sir John Hewett will consider the question of granting advances repayable to Government on easy terms.

We earnestly hope that this important matter will receive the careful and sympathetic consideration of the Government of Bengal.

The Calcutta Corporation is already moving in the matter and has made recommendations to Government for the introduction of certain measures which, it hopes, would put an effective check on the traffic in adulterated food. The Corporation is also considering the desirability of starting a dairy of its own for the supply of pure milk in Calcutta. At a meeting of the Corporation held on the 27th July, 1910, a Committee was appointed to enquire and report upon the whole question of dairy-farming, and the milk-supply of Calcutta generally.

The signs of the time are very promising. In all parts of the country, not even excluding Burmah, an earnest desire for the improvement of the present food-supply is evinced both by the Authorities and by the general public. We anxiously but hopefully look forward to the day when pure food will be readily obtainable in the market on demand, on payment of the proper price therefor.

I have to thank Capt T. F. Owens I.M.S., Chemical Examiner to the Government of Bengal, for kindly going over the whole paper, and Babu Hem Chandra Mitter, retired Subordinate Judge and Babu Anil Prakas Basu M.A., for help in its preparation.

Summary of the Measures recommended in this paper for the prevention of food-adulteration :—

I. The Education of public opinion by the holding of popular lectures on the subject and the distribution of leaflets written in simple language among the general public.

II. The vigorous enforcement of Section 505 of the Calcutta Municipal Act which provides for the destruction of *either unwholesome* or *adulterated food-articles.*

III. The Enactment of a law permitting sale of *pure food only* in the market.

IV. Failing item No. III, the introduction of provisions on the lines of the English law (The food and Drugs Act and the Margarine Act) which—

(1) Restricts the use of the name of an article to the pure article only. If the article be adulterated, it must be sold under some name other than that of the pure article ;

and which—

(2) Insists on all food-articles when imported for sale being accompanied with a declaration from the supplier as to their quality ;

and that—

(3) All food-articles exposed for sale should be labelled in such a way as to give the correct description of their quality to customers.

V. Sec. 495, Clause 2, of the Calcutta Municipal Act should be amended in such a way that a person selling an adulterated article

without guilty knowledge should not be punished (as is provided in the English law) and that he should not be saddled with the cost of destruction of his commodity.

VI. The Registration of all places where food is manufactured to facilitate inspection by the officers of the Health Department and the enforcement of measures for the prevention of infection and adulteration.

VII. The prohibition of the storage of adulterants in places of manufacture of food.

VIII. The enactment of *one law* for Calcutta and the Muffusil, and the making of adequate provisions for bringing the manufactories in the Muffusil under proper control by the appointment of Health Officers by the Muffusil Municipalities.

IX. The appointment of a Board of Analysts in Calcutta to determine and fix the minimum standard of purity of food-stuffs in this country.

X. The establishment of Trade-Combinations.

XI. Aid from Government and the Municipalities for the successful working of dairies started by private enterprise, in the shape of (*a*) facilities for acquisition of pasturage-grounds &c., (*b*) reduction of railway fares for milk-traffic, and (*c*) granting of loans at reduced rates of interest to back private capital.

Some Common Food-stuffs.*

I propose to deal with a few of our common foods in this lecture and to speak to you generally about their comparative nutritive, energy-producing and economic values, the various sources of their contamination and how best to guard against it. The subject is a large one and the time at my disposal is very limited. It will, therefore, be necessary for me to be very brief in my communication.

Food should be considered not only as a necessity but also as one of the great enjoyments of life. It has been a factor of tremendous force in the evolution of the social life of man and has materially contributed to the progress of civilisation. Let stoics and ascetics preach what they will; for the generality of mankind, the æsthetic and social aspects oi food will continue to exercise a healthy and elevating influence on the life of the community.

Uses of Food.

Food is required :—

(1) For the growth of the body;
(2) For the repair of waste;
(3) For the production of heat;

* Proceedings of the Science Convention, Calcutta, 1918.

(4) For the supply of energy for both internal and external work.

Proximate Principles.

To meet all these requirements, our food should contain five nutritive or (as they are generally called) proximate principles and these must be present in certain definite proportions. The absence, excess or insufficiency of any one of these principles does seriously affect our health and brings on disease and premature death. These five principles are :—

(a) Protein, nitrogenous or muscle-building principle ; this is the only one of the five principles which contains Nitrogen ; *(b) Fat* ; *(c) Carbohydrates* ; *(d) Salts* ; *(e) Water*.

The last four do dot contain Nitrogen.

Percentage of Proximate Principles.

All substances which we take as food do not necessarily contain all the five nutritive principles, and even when these are found in one and the same food, they do not exist in the same but in widely varying proportions. For instance, meat and fish contain only protein, fat, salts and water but no carbohydrate. Lard, ghee or mustard oil contains fat only and no other nutritive principles. Sugar contains carbohydrate only, whereas milk, rice, dal, wheat, fruits and vegetables contain all the five nutritive principles together in varying proportions. Nearly all foods contain water and salts except sugar, vegetable oils, animal fats &c.

The following table shows average percentage of the various nutritive principles in some of the common food-suffs :—

TABLE I.

Nutritive Principles (percentage) in Common Food-stuffs.

Name.	Water.	Protein.	Fat.	Carbo-hydrate.	Salts.
Rice	11.06	6.71	0 90	80.10	0.68
Pulses (*Dal*)	11.30	23.90	2.29	55 90	7.10
Flour (Wheat)	15.00	11.00	2.00	71.20	0.80
Oatmeal	15 50	12.60	5.60	63.00	3.00
Bread	40.00	8.00	1.50	53.10	1.30
Chapati	17.33	9.43	3.71	69.20	0.33
Milk (Cow's)	86 87	3.97	4.28	4.82	0.60
Butter	7.50	1.00	90.50	...	1.00
Chhana (Fresh milk-curd)	57.02	22.33	18 64	0.38	1.63
Cheese	36.00	31.00	28.50	...	4 50
Meat	74.40	20.50	3.50	...	1.60
Fish	78 00	18.10	2.90	...	1.00
Eggs	73.50	13.50	11 60	..	1.00
Potato	74.00	2.00	0.16	23 00	1.00
Ground-nut	8.30	24.00	44.30	17.00	1.90
Almonds	6 00	24.00	54.00	10 00	3.00
Plantain	76 47	1.80	0 13	14.15	0.97
Cocoanut pulp (Dry fruit)	19. 3	5.94	53.14	5.46	1.39
Biscuit	8. 0	15. 6	1.3	73.4	1.7
Green peas	78.44	6 35	0.53	12.0	0.81
French beans	90.20	2.73	1.18	5 16	0.72
Cream (Devon)	28.67	4.05	65.01	1.72	0.49
Barley	11.3	12.7	2.0	71.0	3.0
Greenvegetable	91.0	2.05	0.34	5.33	0.81
Dahi (curd)	87.84	4.77	3.57	2 8	0.62

Functions of the Proximate Principles.

PROTEINS.

The foods from which we draw the largest supply of *protein* are meat, fish, eggs, milk and its various products, and *dal*. Nuts (among fruits) also yield a large amount of protein but their use as food is limited. The proteins contain Nitrogen, Carbon, Hydrogen, Oxygen and Sulphur. The *protoplasm* (the building material of the body) is a nitrogenous substance and we must, therefore, supply our body with proteins or nitrogenous food for its growth and repair. This function can not be performed by the other nutritive principles of food, such as fats and carbohydrates, water and salts, which contain no Nitrogen. We can get protein either from animal foods such as meat, fish, eggs and milk or from purely vegetable foods such as rice, wheat, *dal*, fruits and vegetables. Experience shows that it is greatly to our advantage if part of the protein is derived from animal-foods which greatly improve the nutritive value of a dietary, but it does not necessarily follow that we should get it from meat, eggs or fish. We can get it from these foods. if we like or we can equally well obtain it from milk which contains casein (fresh milk-curd) which is the best of all animal-proteins. Our Indian experience shows that perfect health, strengh and the necessary amount of heat and energy can well be had from a mixed diet

of vegetables and milk and milk-products. In any event, protein in some form or other must be present in our food in proper quantity, as otherwise a low state of health will follow and we may fall victims to wasting diseases. Proteins are also necessary for the manufacture of certain secretions of the body. They also (although to a very limited extent) help the production of heat and energy and take part in the formation of fat.

FAT

We get fat from different kinds of animal fats and vegetable oils, such as butter, ghee, lard, mutton-fat, mustard oil, olive oil, sesamum oil, cocoanut oil, ground-nut oil &c. Fat contains Carbon, Hydrogen and Oxygen only. Fat meat, some varieties of fish such as *hilsa* &c, some fruits such as cocoanut, ground nut and walnut &c, eggs and milk contain a large percentage of fat. Fats when taken are burnt up in the system and yield heat, part of which is used to maintain the body-temperature and the rest is converted into mechanical energy necessary for the work of the internal organs such as the heart, lungs &c., and for our muscular activities for doing all kinds of work. Fat is the best energy-producer of all kinds of foods, its power in this respect is nearly twice as great as that of protein and carbohydrates, although the last is superior to fat in its ready combustibillity, and therefore, a much more quick

producer of energy. Fat also helps the formation of fat in the body.

CARBOHYDRATES.

The carbohydrates, like fat, contain Carbon, Hydrogen and Oxygen only and include the various kinds of starch and sugar. All cereals such as rice, wheat, barley, oats &c. abound in starch. Sugar in one or other of its three common forms, viz., grape-sugar, cane-sugar and fruit sugar, is abundantly present in the fruits, stems and roots of certain plants. Carbohydrates, like fats, act as fuel in the body (like coal in a steam-engine) for generating heat and power. As they are more easily burnt in the system than fat, they are the cheapest and the most quick producers of energy among all the nutritive principles of food. At one time, meat was believed to be the greatest energy-producing food ; that theory is now no longer tenable. Sugar is now considered to be the best energy-producer, and therefore, the best strength-giving of all foods. In our daily dietary, rice, bread, ghee, butter, vegetable oils and sugar mainly supply the energy for work. Proteins are needed to build up the body or repair the waste caused by work, but not ordinarily for producing energy.

Fats and carbohydrates are exchangeable to a very large extent (their physiological function being nearly the same) but carbohydrates cannot entirely be replaced by fat in a dietary,

if we want to maintain a normal standard of health. There is a limit to the quantity of fat absorbed by the system, beyond which the excess taken is rejected by the bowels. The whole energy (about 3000 calories) daily required by an adult person of average weight and height doing ordinary work cannot, therefore, be advantageously obtained form fat alone. We must take carbohydrates in the form of starch or sugar to obtain a great part of the energy. Carbohydrates are converted and stored in the liver as *animal starch* (Glycogen) for the future use of the body. It may also be converted into fat in the body. It is a well-known fact that those who take too much fatty and starchy food, such as ghee, sweets, rice and potatoes, get fat-tend. This is why some of our rich men, indulging too much in such foods and taking too little exercise, grow to an unwieldy bulk and generally suffer from diabetes.

SALTS.

Salts (like protein) act as the builder of certain tissues in the body. The phosphate of lime goes to form the bones. The chlorides help the formation of the gastric juice, the carbonates keep up the alkalinity of the blood, and the iron in combination with the red colouring matter of the blood (hæmoglobin) acts as the carrier of oxygen to all parts of the body for the combustion of the ingested food and pro-

duction of heat and energy. Absence of certain salts in the food produces disease.

WATER.

Water plays a most important part in the metabolic activity of the body. It replaces the loss of water suffered by the body in various secretions and excretions, it keeps up the normal fluid state of the blood, it helps in the elimination o the waste-products, it contributes to the regeneration of the various secretions of the body, it helps in the proper dilution of the products of digestion, making them fit for absorption, and by constant evaporation from the skin, it helps to regulate the temperature of the body.

Proportions and Quantity.

We thus see that all the five nutritive principles of food are needed in order to maintain the body in a normal standard of health and efficiency. They must be present also in certain definite proportions in our dietary.

The required proportions for a grown-up man weighing about 150 lbs. and engaged in ordinary work are about 4 ounces of protein, 2 ounces of fat, 17 ounces of carbohydrates and 1 ounce of salts, i. e., about 24 ounces in 24 hours in a water-free condition. This we find out by chemical analysis of all the waste-products of

the body. But we donot get the principles water-free in our food as we take it. All our foods contain more or less water. For instance, green vegetables contain from 90 to 95 percent, milk 87, fish 75, meat 70, wheat 15, rice 12 and *dal* 11 percent of water. On an average, there is about 50 percent of water in our food in the form in which we take it. Therefore, the total quantity of food containing all the nutritive principles in the above proportions which is required for an adult weighing about 150 pounds and doing ordinary work, after making allowance for the presence of water in them, would be about 48 (24 × 2) ounces, i. e., about $1\frac{1}{2}$ seers or in order words, about $\frac{1}{3}$ ounce for every pound of his body-weight. This would give him the required quantity (4 ounces) of the muscle-building element (proteid) and the total amount of heat and energy (3000 units of heat) for his daily work. A suitable diet must make up for the loss of all the elements and also of heat from the body in 24 hours. Taking into account the two principal elements only, this loss has been estimated by careful experiments to be about 300 grains of Nitrogen and 4500 grains of Carbon, together with 3000 units of heat in the case of a strong youngman of average height, weighing about 150lbs and doing a moderate amount of exercise. For hard work, a larger quantity of all these various constituents would be required, and for a man of sedentary habits, the quantity should be reduced.

The amount of heat yielded by a given weight of any food and the total quantity of heat lost from the body in 24 hours can be accurately measured by an apparatus called the Calorimeter.

We require from 50 to 80 ounces of water daily. A part of it is contained in our food, the rest we take in the form of drink as water or in the form of other beverages such as tea, coffee, ærated waters &c.

Vitamines.

Besides the nutritive principles, there must be present another class of substance in our food called the *Vitamines*, the composition of which has not yet been accurately determined but which the body needs for its normal growth and nutrition. They are present in milk, meat, butter, eggs, rice, wheat and in fresh vegetebles and fruits. They have a profound influence on the body-metabolism and their absence gives rise to deficiency diseases such as Beri-beri, Ricket, Scurvy &c.

These are classed under three heads ;—

1. *Fat soluble* A.—Present in milk, butter, in germinating grains and in fresh vegetables.

2. *Water-soluble* B.—Present in cereals ; its absence in food causes Beri-beri.

3. *Water-soluble* C.—The absence of this in food causes Scurvy.

Diet-Tables.

I give below two diet-tables for Bengalis in their growing period of life. These would give them all the nutritive principles in required quantity and the full amount of energy.

Table II would give 300 grains of Nitrogen, 4500 grains of Carbon and 3000 calories (units of heat) to a strong youngman 5ft 8in. high, weighing about 150 lbs and taking a good amount of exercise.

TABLE II.

Food-stuff	Quantity in ounces
Rice	5
Dal (Pulses) ...	2
Meat or Fish ...	6
Potato	10
Other vegetables ..	6
Flour	10
Soojee	2
Ghee or Oil	1½
Sugar	1
Curd (Dahi) ...	4
Salts	1
Spices	As necessary

The above quantity of food should be distributed over 24 hours according to the convenience of the consumer, but five to six hours should be allowed to intervene between two full meals.

Table III is for an adult person of average height, weighing about 120 lbs and doing ordinary amount of exercise.

TABLE III.

Food-stuff	Quantity in ounces
Rice	6
Flour	10
Dal (Pulses)	3
Fish or Meat ...	5
Potato	4
Other vegetables ...	4
Ghee or Oil ...	1
Milk	16
Salt	1
Spices	As necessary

The above dietary would yield about 251 grains of Nitrogen, 4537 grains of Carbon and 2800 units of heat per day. For every additional pound-weight of the body, $\frac{1}{40}$ ounce of protein-food should be added to the diet in the shape of meat, fish, dal or fresh milk-curd (chhana).

Hutchinson lays down the following dietary for a healthy adult Englishman doing a moderate amount of exercise :—

TABLE IV

Food-stuff	Quantity in ounces
Bread	16
Meat	8
Butter	4
Potato	16
Milk	10
Eggs (two)	4
Cheese	2

After these preliminary observations on the construction of a proper dietary, I proceed to consider briefly the composition and quality of some of the common food-stuffs in our daily use.

MILK.

I have stated that all foods do not contain all the nutritive principles nor are these principles contained in the same proportions in all food. The only food which contains all the five nutritive principles in proper proportions is milk which, we all know, is designed by kind Nature for the support of life and growth of body in the case of all young mammals. But although it is suitable for children, the exclusive use of milk is not considered suitable for grown-up people, as a very large quantity (about 4 seers) has to be taken which means the taking of a large excess of water and some of the other nutritive prin-

ciples, and it has the disadvantage of a monotonous diet. These objections can, however, be got over if milk is taken not as fluid milk only but in the form of its various solid products.

The composition of milk is practically the same in all animals but the proportion of the nutritive principles varies, sometimes widely, in the milk of different animals. The following table gives a comparative precentage composition of human milk and the milk of some of the domesticated animals :—

TABLE V.

Mlik.	Protein.	Fat.	Carbohydrate.	Salts.	Water.
Human	2.97	2.9	5.87	0·16	88·0
Cow's	4.0	4.50	4.40	0·70	86·4
Buffalo's	4.52	8.20	4.60	0·88	81·80
Goat's	3.62	4.20	4.0	0·56	87·84
Ass's	1.79	1.02	5.80	0·42	91·17

While milk and its various products form a very important substance in the dietary of all nations, they are indispensable in the case of the Indians. A large proportion of the people of India do not touch meat or fish ; the principal source of protein and fat in their diet is milk and milk-products. Owing to its dearness and the difficulty in getting milk of good quality, the diet of the majority of the people in towns and cities, who are men of small means, suffers

in its nutritive value and their physical development suffers accordingly. The problem of milk-supply in India is daily becoming more difficult and unless a satisfactory solution is soon arrived at, we cannot expect to see any improvement in the health of the people whose principal diet has all along been milk.

Here in Bengal, milk is generally adulterated with water and the specific gravity thus lowered is raised by the addition of cane-sugar. Cow's milk of good quality should contain not less than 3·5 percent of fat and 8·5 percent of solids other than fat, and its specific gravity should not be less than 1028. The Bengal Cow's milk contains on an average 4·5 percent of fat. Cream is often separated from milk and water is added to it to lower its density. This fraud cannot be detected by the Lactometer test; for this, a full analysis of milk is required. Buffalo-milk which contains a high percentage of fat is often largly diluted with water and sold as cow's milk. Milk is often made the carrier of infectious diseases such as cholera, typhoid fever &c., through the medium of dirty water used for its dilution.

The extremely insanitary condition in which cows are generally kept and milk is drawn and sold in this country is another potent source of infection of the milk. Milk from cows suffering from tuberculosis is not a safe article of food.

The only way to make milk a safe food, specially in India, is to boil it before use. Even pasteurisation can not be depended upon in all cases. The best authorities on food now agree that milk does not appreciably suffer in quality by being boiled.

Cow's milk is largely used as infant-food. It should be well-diluted with water and mixed with a little cream and milk-sugar before being given to little children.

Both cow's milk and baffalo-milk are largely used in India for the manufacture of various milk-products which enter largely into the dietary of the Indian, rich and poor. Much of the fat of milk separates and floats on the top when it is allowed to stand for some time in a cool place. This is known as *cream* and contains from 18 to 25 percent of fat. The milk from which the cream has been skimmed off goes by the name of *skimmed milk*; it still contains a little fat and other nourishing elements and is used as food, specially in the treatment of certain diseases as *diabetes*.

Dahi (Curd):—When warm milk is treated with the *dahi*-ferment (Lactic acid bacilli) and allowed to stand undisturbed, it gets curdled and forms curd (*Dahi*) which is used as a daily article of food in India, both by the rich and the poor. It contains all the nutritive principles of milk viz., protein 4·77 %, fat 3·5% and a very small quantity of sugar, most of the sugar being converted into lactic acid by the fermentation process. *Dahi* agrees with many people who can not digest milk. It is said to stop the growth of injurious bacteria in the intestinal canal, which, according to Metchnikoff, bring on permature old age and decay.

Chhana (Fresh milk-curd):—If an acid substance such as lime-juice or a certain ferment called rennet is added to milk, it gets curdled and forms a mixture of solid and liquid. The solid part is separated by filtration through a piece of cloth and pressed to remove water as much as possible. The liquid portion (Whey) mixed with a little sugar forms an agreeable drink in fever cases. The solid portion is the fresh milk-curd (*Chhana*) which is one of the best protein-foods we have got. It is even superior to the proteins obtained from meat and fish as it contains no injurious extractive matter (Purin bodies) from which meat and fish are never free. It is comparatively cheaper than meat and fish and their is no waste by its purchase in the shape of bones, entrails and scales. The high nutritive value of *chhana* will appear from its composition given below—

Protein	22·62 percent.
Fat	18·64 ,,
Carbohydrate	0·88 ,,

Salts	1·62	„
Water	57·02	„

Owing to its high protein and fat values, it should enter largely into the dietary of the rice-eating Bengalis.

Many sweetmeats are prepared from *chhana* of which *sandesh* (made of *chhana* and sugar) is the best. It is the most nourishing and palatable of all kinds of Indian sweets and is very rich in protein and fat. It may practically be taken as a complete food. The analysis of the best *sandesh* gave the following results :—

Protein	18·17	per cent
Fat	19·75	„
Carbohydrate ...	37·18	„
Salts	1·65	„
Water	20·25	„

Cheese :—It is milk-curd which has been subjected to a certain kind of fermentation and to a process of drying and pressing. It is obtained by adding rennet (a kind of ferment obtained from sheep's stomach) to milk. It is a highly nutritious food, containing more protein and fat than meat, fish or *dal*. It is a most important protein-food for poor people in Europe; when moderately taken, it is a fairly easily digestible food. One should, however, be careful in using old cheese, as some-times a deadly poison (Tyrotoxicon) develops in it giving rise to symptoms resembling those of cholera and sometimes producing fatal results. People with weak digestion should sparingly use cheese.

Butter :—It is produced either from milk, cream or curded milk by churning. It is an important but costly article of diet, highly cherished all over the world. Buffalo-milk yields a much larger amount of butter than cow's-milk and most of the *ghee* in India is prepared from it. Butter is an important source of heat and energy in our diet and there are communites among the Hindoos who can not do without *ghee* obtained from butter. Butter is one of the articles of food which is very largely adulterated, generally with water and inferior kinds of fats and oils and sometimes with pulps of fruits and starch. Sometimes, other animal and vegetable fats are churned with skimmed milk, coloured yellow and sold as butter in the market. The chief adulterant of butter is water. Good butter should not contain more than 10 percent of water. It is generally mixed with about 3 percent of common salt for the purpose of preservation.

Ghol (Butter-milk) :—The milkly-white thin fluid after the separation of butter is called *ghol* and is largely used as a cooling and nourishing drink in India in hot weather, specially after the morning meal and as a nourishing diet for sick people. This is held in high regard as an article of diet among the Hindoos, as will appear from the the following Sanskrit stanza :—

दिनान्ते च पिवेत् दुग्धं निशान्ते च पिवेत् पयः।
भोजनान्ते पिवेत् तक्रं किं वैद्यस्य प्रयोजनम्॥

One who drinks milk in the evening, water in the early morning and *takra* (Ghol) after meals, should never need the services of a physician.

Ghee :—It is made by melting butter at a moderately high temperature by which all the water contained in it is driven out and then the liquid strained while hot to remove curdy matter. It is one of the most important constituents of the Indian dietary. Besides being taken with rice, it enters largely into the composition of other foods daily taken by the Indians and it is no exaggeration to state that no Indian home, rich or poor, can do without it. Buffalo-milk yields the largest amount of ghee which is a little cheaper than cow's ghee and, therefore, has a much larger consumption. Cow's ghee possesses an agreeable flavour and as an article of food, is more highly prized than buffalo-ghee. In certain religious ceremonies of the Hindoos, cow's ghee is used in preference to buffalo-ghee. Good ghee should be white or yellowish, granular and should possess an agreeable odour. It may be semi-solid or a mixture of solid and liquid (cow's ghee). Old ghee becomes rancid, gives as offensive smell and is unfit for food.

No article of food in India is so much adulterated as ghee. All kinds of animal fats and

vegetable oils such as ground-nut oil, mowa oil, cotton seed oil &c. are largely used as adulterants of ghee. Many so called samples of ghee sent from Calcutta to muffasil for sale are only mixtures of lard and ground-nut oil. An Act has recently been passed for Calcutta restricting the sale of any substance under the name of ghee which does not consist of milk-fat only, and we hope it will prove a sufficient check to the dishonest practice.

Kheer (Khowa) :—It is dessicated milk in the from of yellowish-white pasty lumps, having an agreeable odour and sweet taste. It enters largely into the composition of many palatable and nourishing sweetmeats in daily use in Indian houses.

Condensed milk ;—It is milk thickened by heating it in vacuum with or without the addition of cane-sugar. It is somewhat less nourishing than fresh milk, many varieties being deficient in fat. It is, however, a good substitute for milk where fresh milk is not available.

Milk is indispensable for children and it is an invaluable food for the sick and the aged people.

MEAT.

It is the chief protein food of man in all parts of the world. In pre-historic days, it fomed the only food for uncivilised man.

Beef, mutton, pork and goat's flesh are called *red or butcher's meat* and are less easily digestible than *white meat* which belongs to the domestic fowl. The average composition of various kinds of meat is shown in the following table :—

TABLE V.

Meat.	Protein.	Fat.	Carbohydrate.	Salts.	Water.
Beef	20·0	1·5	0	1 3	76 5
Mutton	18·0	5·7	0	1·3	75·0
Pork	12·3	26·2	0	0 6	60·9
Goat's	24·06	2·5	0	1·2	72 0
Fowl	23·30	3·1	0	1·0	70·0
Vension	19·7	1 9	0	1·1	75·7
Duck	22·0	3·0	0	1·0	70 8

Meat is a dear food and the majority of the poor people all over the world has practically to do without it. A large number of people in India do not touch meat or fish, either on religious grounds or because of social customs. It may be stated here that meat or fish is not absolutely necessary for health or strength, as one can procure the necessary quantity of protein from vegetable foods and milk and milk-products. A too liberal use of meat in tropical climate upsets the liver and causes gout and renal colic. The protein of meat is very easily digested and is readily assimilable.

One should take particular care in the selection of meat as it harbours dangerous parasites and microbes. Meat from animals suffering from tuberculosis, anthrax and rinderpest should be rejected. Different species of tape-worm and other parasites (Tinea Solium, Tinea Mediocanelleta, Trichina Spiralis &c) are known to infest pork and beef and such meat should be avoided, as it gives rise to serious troubles in man. A thorough inspection of the carcass and meat before sale is necessary and this should be done by the officers of the Health Department.

Good meat should not be too red nor too pale. It should be firm and elastic, must not pit or crackle on pressure, nor give off an unpleasant odour which points to decomposition. The fatty layer on the meat should be yellowish-white in colour and firm. Putrid meat shows greenish spots and smells. Meat with measly appearance indicates infection with parasitic worms.

Meat should be thoroughly cooked, otherwise the parasites and microbes present in it are not killed. Under-done meat, unless it is free from infection, is not a safe food.

Sometimes, a kind of chemical poison (Ptomaines) develops in meat in which decomposition has just set in. The consumption of such meat has been followed by severe gastro-intestinal symptoms resembling those of cholera,

often attended with fatal results. This poison is not destroyed by boiling and can not be detected by the inspection of meat. Vegetarians practically enjoy immunity from ptomaine poisoning.

Soups made of meat contain little or no nourishment. They mostly contain extractives and act as stimulants only.

FISH.

It ranks next to meat as a nourishing animal food.

The following table shows the percentage composition of some of the more common kinds of Bengal and English fish :—

TABLE VII.

Name.	Water.	Protein.	Fat.	Salts.
Rohi	74.6	18.35	7.56	1.42
Magoor	78 85	19 49	0.50	1.30
Koi	81.83	17.73	0.42	1 06
Mango fish	77.82	16.76	4.12	0.83
Tengra	77.70	17.28	0.30	1.15
Bhetki	77.27	16.26	4.12	0 84
Hilsa	76.33	14 85	9.23	0.95
Herrings	80.71	10.11	7.11	...
Salmon	77 0	16.10	5.50	...
Sole	86.14	11.94	0.25	...
Mackerel	68.70	23.50	6.76	...

The best fish in Bengal is the *Rohi* which contains nearly 18 per cent of protein and 8 per cent of fat. *Hilsa generally* contains much fat and is, therefore, somewhat difficult to digest. But it is a valuable strength-giving and energy-producing food. It is largely consumed in East Bengal where it is cheap and people there are much better off in strength and vigour than their brethren of West Bengal. *Koi* and *Magoor* form good invalid food as they contain very little fat. Fish contains less extractive matter and is, therefore, less stimulating than meat. It is generally deficient in fat and is, therefore, more easily digestible than meat. It is not an economical food in towns like Calcutta. The wastage in bones, entrails and scales &c is about 50 per cent.

Lobsters and crabs do not belong to the genera of fish but to the Crustacea; they are largely eaten but are somewhat difficult to digest. They contain about 15 per cent of protein but very little fat. Their consumption is sometimes followed by wheel-like skin-eruptions.

Oysters are largely eaten in England. They contain about 6 per cent of protein and 1.5 per cent of fat. They live in polluted water and are knewn to have carried typhoid infection.

Fish generally does not carry infection except a few tribes (Pike, Trout and Turbot) which give a kind of tapeworm (Bothriocephalus Latus) to man. Fish rapidly undergoes decom-

position in hot climate ; putrid fish is poisonous. Some people ascribe leprosy to consumption of putrid fish but this theory in no longer tenable. Salted fish is much less nourishing than fresh fish.

Fresh fish should be firm on pressure and should give no bad smell, specially from the gills. The eyes should look bright and the tail should not droop when unsupported. Scales should not easily come off in fresh fish.

The idea that fish is a brain food is now disputed but the point has not been definitely settled.

EGGS.

Egg is a very nourishing but not an economical food. On an average, it contains about 12 per cent of protein and 15 per cent of fat. Very valuable salts of phosphorus and iron are present in the yolk of egg. In a rice-diet, eggs would make up the deficiency of both protein and fat. There is not much difference in the composition and properties between hen's eggs and those of ducks ; the latter contains a little more fat. Eggs should be eaten half or quarter boiled. Hard boiled eggs are difficult to digest.

To test the freshness of eggs, they should be put in salted water (2 ounces of salt in a pound of water). If they do not sink, they should be rejected.

Eggs may be preserved by coating them with a thin layer of melted wax or with a solution of silicate of soda.

Eggs are free from purin bodies and are rich in vitamines.

CEREALS.

Wheat, rice, barley, oats, maize or Indian corn, millets (jowar & bajri) &c., belong to this class.

Wheat :—Whole-meal flour is preferable to white flour. White flour is no doubt more easily digestible than whole-meal flour but it is deficient in vitamines and salts. Whole-meal flour contains the germs and the outer coatings of wheat in which all vitamines and salts lie. Whole-meal flour relieves constipation. Flour is made into English bread, *chapatees* and *poorees* or *loochis*. Chapatees contain more protein and less water than English bread but is somewhat less easily disgestible because it is often under-baked and it is not so light and spongy like the English bread which is easily acted upon by the digestive juices. *Loochee* or *Pooree* is too rich in fat and is a costly food. People inclined to stoutness should avoid it. Biscuits are more nourishing than bread, because they contain more protein and less water.

Flour is often adulterated with rice-starch, specially when the price of wheat goes up. The fraud is detected by a microscopic examination of the flour.

Flour should form one meal of the Bengalis, particularly in their growing period of life. Bread and milk form a most nourishing dish. *Soojee* (obtained from wheat-flour) is a light and nourishing food. *Halooa* made of *Soojee*, ghee and sugar is a very palatable and wholesome preparation. Old flour, specially if kept in a damp place, becomes infested with fungus-growth, weavils and worms and is unfit for consumption.

Rice :—It is the staple food of the Bengalis, the Ooryas and the Madrasis. The *Atap* (sun-dried) is more nutritious than the *siddha* rice (made from steamed paddy). Rice should not be too much polished, as vitamines and salts are thereby lost and a kind of disease called Beri-beri (Polyneuritis) is said to be caused by the consumption of such rice. Rice-water should not be thrown away after cooking rice, as rice is poor in nitrogen and some of this and the salts are lost by the throwing away of the rice-water. A combination of rice, *dal* and ghee with potato, salt and spices in the form of *Khichuri* makes a very palatable and nourishing dish which should be more largley introduced in Indian homes. Rice should make room for *chapatee* in one of our meals. Rice is a valuable economical food as it produces a large quantity of energy and is most easily digestible, but it is very poor in nitrogen and fat.

Rice, milk and sugar with raisins, all boiled together, constitute a kind of pudding (*Paramanna*) which is very palatable and nourishing.

Old rice is perferred to new rice as the latter generally causes flatulence and diarrhœa. Old and new rice are mixed together by dishonest dealers and then whitened with chalk or lime to give it the appearance of old rice.

Oatmeal is the most nourishing of all cereals; it is rich in both protein and fat.

DAL (PULSES).

The different kinds of *dal* take the place of meat in our Indian dietary and they have very strong claims to do so. They contain a large amount of protein, larger than the average quantity found in meat or fish, and they also contain a considerable quantity of starch and salts. They are generally poor in fat; ghee or some kind of oil is, therefore, always used in preparing *dal*.

The following table gives the percentage composition of the common forms of *dal* :—

TABLE VIII

Name.	Water.	Protein.	Fat.	Carbohydrate.	Salts.
Moong	11 40	23.80	2.0	54.80	9.0
Masoor	11.80	25.10	1 3	58.40	3.4
Arhar	13.30	17.10	2.6	55.70	11.3
Khesari	10.10	31.90	0.9	53.90	3.2
Kalai (*Mash*)	10.10	22 70	2.2	55.80	9.2
Boot (*Chhola*)	9.58	23 66	4.3	60 02	2.4
Matar	15.0	22.0	2.0	53.0	2.4

On economic grounds, *dal* holds a much superior place to meat; it is sometimes called the "poor man's beef." A seer of meat costs one rupee; a seer of *dal* (except *moong*) seldom costs more than 3 annas in ordinary times. 70 per cent of meat is water, whereas *dal* contains only 11 per cent of water; 20 per cent of meat as purchased from the market is waste; there is practically no waste in *dal*.

Dal is generally believed to be not an easily digestible food. We would submit that the digestion and assimilation of food depend much on habits and on individual tastes. If well-prepared, *dal* sits as kindly on Indian stomach as meat does on European stomach. It can be prepared in a very large number of varieties of attractive dishes, and it does not carry any focus of infection with it as meat often does.

Dal should be prepared in such a way that the grains are lost sight of; cooked *dal* should have a uniformly thick cream-like consistence.

Dal-bhat or *dal-rotee* with ghee or oil, vegetables and milk (or one or other of its products) has always formed (and will remain so for a long time) the daily food of the majority of the Indians, and considering the habits and religious sentiments of the people, their economic condition and the climate of the country, such a diet is eminently suitable for them.

FATS AND VEGETABLE OILS.

I have already referred to ghee being an article of food much in demand by the Indian

people. As sold in the bazar, ghee is the most adulterated of all food-stuffs except perhaps milk. It ranks first among all energy-producing foods. People who take meat generally take a good quantity of fat with it. But people who live on vegetables have to depend upon milk, ghee or vegetable oils for the supply of fat. Ghee has become so costly that poor people cannot afford to use it. They generally use mustard oil, gingelly oil, ground-nut oil or cocoanut oil as a substitute for ghee and they get nearly the same benefit by their use. Ground-nut oil is cheap and has an agreeable smell. Cocoanut oil approaches ghee more closely in its composition than any other vegetable oil. Fresh cocoanut butter is an excellent edible vegetable fat. In these days of scarcity of pure ghee, its place can be well taken up by one or other of the vegetable oils. Mustard oil is largely used in Bengal for culinery purposes.

VEGETABLES.

The roots and tubers consist chiefly of carbohydrates. The green vegetables contain the largest amount of water, some succulent vegetables containing even as much as 96 per cent of water. They are rich in salts and vitamines and in that direction lies their chief dietetic value. They contain much indigestible cellulose which, however, stimulates the action of the bowels and relieves constipation. Some of the roots and tubers contain a good amount of starch and sugar

and are, therefore, nourishing. The vegetables are as a rule deficient in protein except peas and beans, and in fat also. The best of all vegetables is the *potato*. It contains about 20 per cent of starch and possesses high anti-scorbutic properties. People all over the world are fond of potatoes. Potato-starch is well adapted for use in diabetic cases in the place of other starches. Potato should not be boiled with the skin off, as some nourishing matter is lost by this process. It should be steamed, baked or roasted with the skin on. Our young men should take a good quantity of potatoes, not less than 6 or 8 ounces in 24 hours. Prisoners have been kept on a potato-diet and they appear to have thrived well.

Green peas and beans are rich in protein and they, therefore, possess great nutritive value among vegetables.

Jackfruit seeds contain a fairly large amount of protein (about 13%) besides starch; they should be collected, dried and preserved in season, for use throughout the year.

Beetroot and sweet potato contain much sugar and are, therefore, nourishing vegetables. Cauliflowers and cabbages are not very nourishing but they are much liked. Cabbages contain sulphur and are liable to produce flatulence. Ground-nuts are highly nutritious, as they contain large percentages of protein (24 percent) and fat (42 percent); they should more largely enter

into the dietary of our young men. If some of the oil is removed by pressing, the meal forms a food of high protein-value, which has been found to be useful in diabetes. Tomatoes are rich in vitamines.

FRUITS.

India abounds in good fruits. Some of them, such as the various kinds of nuts, contain a large percentage of protein and fat, and they, therefore, possess high nutritive value. Other fruits contain a good amount of sugar. Their general nourishing value is not high (except in the case of nuts such as almonds &c.) but they are most useful for the salts, vitamines and acids which they contain. They possess high antiscorbutic properties, prevent bacterial growth and fermentation in the bowels and act as mild laxatives. Recently, apples have been much extolled as preventing the advent of premature old age. Lime-juice has long been known to prevent the incidence of Scurvy.

ACCESSORIES OF FOOD.

Spices, *condiments* and *chutneys* promote appetite, cause increased secretion of digestive fluids and thus help digestion indirectly. Spices act as carminatives and are necessary to make food palatable, but their excessive use is harmful. *Chutneys* possess antiscorbutic properties.

Tea, *Coffee* and *Cocoa* are not at all necessary for the maintenance of health. They possess stimulating properties but no food-value except for the milk and sugar taken

with them. Cocoa, however, contains some fat but is of very little food-value in the quantity in which it is taken. They do not cause any harm when used in moderation; on the other hand, they are agreeable drinks and relieve fatigue and exhaustion. Their excessive use, however, causes dyspepsia, palpitation, sleeplessness and other nervous diseases.

CONCLUSION.—The above is a somewhat cursory and imperfect attempt at a scientific enquiry into the nature of some of our more important food-stuffs and the broad principles which should guide us in their selection and in determining the quantity of each. It is a subject which deserves a larger amount of public attention than is ordinarily bestowed upon it. We all of us know this much that if we wish to live, we must eat. But beyond that, very few people care to enquire what is contained in our food, what it does in our system, what kind of food we should eat to maintain a proper standard of health and how much of it. If the scanty information furnished in this paper proves helpful in rousing the interest of my readers and in stimulating enquiry into this most important subject, my labours will be amply recompensed.

I append a table showing how much protein, carbohydrates and fat in grammes and energy in calories are available from one ounce of some of the ordinary articles of food in order to help the construction of *diet-tables*. An ounce roughly represents 30 grammes. About two ounces make a *chittack*. On an average, 100 grammes of protein and from 2800 to 3000 calories are needed in 24 hours by a strong healthy adult engaged in ordinary work and doing moderate amount of exercise.

TABLE IX.

(Amount in grammes of protein, fat, carbo-hydrates and calories yielded by an ounce of food).

Food	Carbo-hydrate	Protein	Fat	Calories
Rice (average)	23	2	0·12	94
Dal (pulses)	15·3	6	0·8	92
Milk (cow's)	1·17	1	1·0	20
Flour (wheat)	21·3	3·3	0·6	103
Atta (whole meal)	20·13	3·5	0·87	100
Bread	18	3·0	0·05	90
Potato	6	0·05	0·45	25
Soojee	17·1	4·2	0·55	80
Chhana (Fresh milk-curd)	0·10	6·5	5·5	76
Ghee	0	0	29	222
Butter	0	0	24	222
Mustard oil	0	0	29	222
Beef	0	6	1	54
Mutton	0	4	10	106
Bacon	0	2·7	14·5	141
Goat's flesh	0	7	·75	54
Fowl	0	7	·9	36
Eggs	0	7	3·3	50
Rohi fish	0	4	2·2	54
Magoor ,,	0	5	0·6	30
Koi ,,	0	7	0·8	35
Singee ,,	0	7·3	1·2	40
Lobster	0	5	0·14	21
Dahi (curd)	0·8	1·4	1	17
Sandesh	12	5·4	6	75
Oat-meal	19	3·8	1·7	106
Pearl Barley	22·7	2·1	0·3	101
Khoi (fried paddy)	22·8	1·7	Trace	98
Vegetables (average)	2·5	0·25	Trace	10
Green Peas	2·1	2·5	0·17	39
Ground-nut	7·2	7·5	11 4	161
Walnut	4·8	4·8	19	209
Almonds	5·1	6·3	16·1	149
Pesta (pistachios)	16·2	6·6	4·8	191
Mango (Bombay)	5·2	0·036	0·22	22
Dates	20·60	0·72	0·57	90
Oranges	3·4	0·24	0·06	15
Apple	4·2	0·18	0·15	21
Cocoanut (pulp)	6·0	1·1	16·8	190
Raisins	3·4	0·78	2·4	38

Some Practical Hints to Improve the Dietary of the Bengalis.*

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I do not claim any originality in this paper, but the importance of the subject and the lack of interest shown by people whom it most concerns are a sufficient excuse to me for bringing this matter up for discussion before this learned assembly.

There have been very few investigations based on scientific methods regarding the dietary of the Bengalis. But whenever any attempt has been made in this direction, the dietary has been found to be deficient in *protein* or *muscle-forming constituent*, and over-rich in *carbo-hydrate elements* (starch and sugar). The proportion of fat, except in the case of the well-to-do people, is also generally deficient. The latest investigation into the dietary of Bengali students by Major D. McCay, I.M.S., points to great

* Read at the Science Convention held at Calcutta in 1917 and published in its Proceedings in 1918.

deficiency of *proteins* in their diet, and to this cause, Major McCay ascribes the poor physique and the feeble staying power of Bengali youths.

Now, as the growth, development and capacity for work of an individual as well as the health and vigour of a community depend on the supply of food of the proper quantity and quality, it is of the utmost national importance that greater attention should be given to this subject, specially in view of the changed and changing economic condition of the people.

The subject is not without its difficulty and complexity. Diversity of race and creed, religious sentiments, habits and traditions, the economic condition of the people—all have their bearing on the consideration of this problem. The selection of a dietary, therefore, which will be acceptable to the people in general by not going against their cherished notions, and at the same time, being well within the easy reach of everybody, is a matter of careful thought and judgment. And the matter of prime consideration is that such a dietary must contain all the various nutritive constituents of food, viz., protein, fat, carbo-hydrate and salts, in sufficient quantity and in proper proportions, for the growth of the body, repair of waste, supply of energy and heat for work and maintenance of health.

I propose to consider this question briefly from the above points of view.

The dietary of a Bengali Hindu of the *bhadralog* class consists usually of rice, *dal*, fish, vegetables, ghee, mustard oil, milk or one or other of its various products and sweets, supplemented now and then by a small allowance of fresh fruits varying according to the season. In towns, rice has partially been supplanted in recent times by wheat flour, specially in the evening meals, made into *chapatees* (*rotees*) or *loochis*; but students living in hostels and messes in Calcutta do not get it. In villages and among the labouring classes, rice still forms the principal food for both morning and evening meals. There are a great many varieties of rice grown and consumed in this Province. They are generally of equal nutritive value, the *atap* (sun-dried) and the *balam* being, however, slightly richer in protein than the other varieties. Rice is much poorer in protein than wheat, barley, oats, *makai* (Indian corn) etc., which are used as its substitutes in other parts of India (except Orissa and Madras). The average percentage of protein in rice is 5; it is over 10 percent in wheat, barley, *makai* and oats. Rice is also very poor in fat, but it is very rich in starch, and the rice-starch is one of the most easily digestible of all known starches. The average time taken by boiled rice for complete digestion is about an hour only.

As rice is so very deficient in both protein and fat, it is of the utmost importance that it should be supplemented by food-stuffs which

contain these two constituents in rich proportions. The mistake our people generally make is to take a large quantity of rice (which for the time appeases the appetite) with small quantities of other foods containing protein and fat. The result is that they get fattened (for it is the excess of starch and not so much any excess of fat actually taken with the food that causes deposition of fat in the body), the belly becomes bulging, the muscles become flabby and wanting in tone, strength and activity, and the countenance becomes somewhat sallow and dull but glossy.

I have already mentioned that the marked defect in the dietary of the ordinary Bengali Hindu is the insufficiency of the protein and fat elements in it. It will be my endeavour to show how best this deficiency can be made up. To start with, we must remember that most authorities on food are agreed that at least 80 grammes (1235 grains) of protein are daily required for an adult engaged in the ordinary duties of life. A careful examination, however, of the average daily diet of a Bengali Hindu reveals the fact that not more than 50 grammes of protein are availabie to an adult Bengali in the dietary that usually obtains in his household. In the case of children, this deficiency is even more marked. The Bengali mother has a great partiality for rice and much dread against *dal*, and if her child takes a large quantity of rice with the help of a little fish-soup (the fish form-

ing only a negligible ingredient in the latter dish) and finishes the meal with a little milk and brown sugar, she is well satisfied. Such a dietary is, however, most unsuitable for young people in the growing period of life when protein is most wanted, not only to help the growth of the body but also to repair the great tissue-waste caused by the ceaseless activities of young life.

The only way to remedy this defect is by taking less quantity of rice and consuming larger quantities of food-stuffs that are rich in protein and fat. Among food-stuffs which contain the largest proportion of protein, the most common are, meat, fish, eggs, milk and various kinds of pulses (*dal*). Meat, on an average, contains 20 percent of protein, fish 18 percent, eggs 14 percent, milk 4 percent and *dal* about 24 percent. We must make our choice of any one or more of these five articles of food to make up the deficiency of protein in rice. Meat is not only rich in protein which is easily assimilable but it is also agreeable to the palate ; it is, therefore, that we see that, except among certain communities in India, people all over the world who can afford to have it, show a great partiality for this food. Moreover, meat is a stimulating food, more stimulating than either fish or *dal* and is, therefore, much appreciated. It is, however, a costly food, and the average Bengali cannot afford to have it included in

the daily dietary of his family, unless it is taken in the form of some cheap variety which, however, is a forbidden food to the Hindu. If his requirement is a *seer* of mutton or goat's flesh daily for the use of his family, it means an expense to him of at least twelve annas * per day, which very few people of the ordinary middle class are able to bear, not to speak of the labourers, cultivators or artisans. While, therefore, the introduction of meat into the daily dietary of the Bengalis will undoubtedly tend to improve it—as a matter of fact, it has already been introduced into the dietary of the well-to-do classes—this innovation on a consideration of all the circumstances, seems to me to be very expensive and, therefore, impracticable in the case of the vast majority of the Bengali Hindus. Besides, there are a considerable number of people belonging to that community, more specially the women-folk, who would, on no account and under no circumstances, take meat. Meat cannot, therefore, ordinarily take its place in the Bengali dietary to make up for the deficiency of protein in rice.

We next come to fish, which is one of the commonest articles of diet in Bengal and is nearly as rich in protein as meat. It has the great advantage over butcher's meat in being more easily digestible, less constipating, and less stimulating which makes it specially

* The price has since gone up much above this estimate. *EDITOR*

suitable in the case of the young people whose diet should be most nourishing but at the same time, least stimulating. There are some fish which contain much fat (oil), such as *Hilsa*. These are somewhat difficult to digest. There are others which are poor in fat, such as *Koi*, *Magoor* and *Singhee*; these are easily digestible and, therefore, sit better on weak stomachs and form an excellent invalid diet. The best fish from all points of view are the *Rohi*, *Katla*, *Bhetki*, *Bhangon*, *Parse*, and a few others; these are rich in protein, contain moderate quantities of fat, are agreeable to the palate, and no wonder they are largely consumed in Bengal. *Chingri* (lobsters and prawns) is no fish at all; it is palatable but difficult to digest and often brings on gastric troubles.

There was a time when every Bengali, rich or poor, used to get plenty of fish with his meals and then his dietary was not defective either in protein or in fat. I remember, in our younger days, good *Rohi* fish used to be sold in Calcutta at four annas a seer, and other kinds of fish could be had at a much less cost. In the mufussil, the usual price was 2 annas per seer. But fish has become a very costly article now, not only in towns but also in villages in the West Bengal. The state of things is much better in East Bengal where plenty of this important food-stuff, either fresh or in the salted or dried condition,

can still be had at a small cost. Good fish ordinarily sells at twelve annas a seer in this town and the price often goes as high up as a rupee.* In places around Calcutta, the price is very often not lower, and sometimes it connot even be had either for love or for money. To a Bengali, whether rich or poor, a little fish is indispensable in his daily diet. The ordinary householder cannot afford to buy more than half a pound of fish a day for the whole family which usually consists of not less than six members; this would give only three quarter of a chittack (one and a half ounces) of fish per head. The bones and scales and the entrails, constituting as they do about 50 percent of the fish as bought from the market, would further reduce the share of each individual by nearly half in the prepared fish. Remembering also that fish contains as much as 78 percent of water, we see that what each member of the family ultimately gets is only an apology for fish in his daily meals which gives him very little protein to make up the deficiency in his rice-diet. The only fair average allowance of fish for an individual (where no meat is taken) would be a quantity of not less than 3 chittacks (6 ounces) per day. Thus, if the family consist of 6 members, the daily consumption of fish would come to about $1\frac{1}{4}$ seers which would mean an expense of at least a

* The usual price at present is Rs. 1/4 per seer.—*EDITOR.*

rupee on this head only and this, I am afraid, very few people in ordinary circumstances can afford to spend.

The state of things being different in Eastern Bengal where fish is to be had cheaply, people over there enjoy much better health ; their average stature is generally higher, the make and the muscles of their body stronger and they are capable of doing greater amount of labour and enduring greater fatigue than their brethren of Western Bengal.

Eggs are an excellent article of food, rich in protein and fat, and should, wherever possible, be introduced into the diet of our young men.* Duck's egg contains about 13.5 percent of protein and about 14 percent of fat. It is, however, a costly food and its price has more than doubled within recent times. Besides, eggs are not liked by many people and among Hindus, there is objection to the use of hen's eggs (or even duck's eggs) on religious grounds. Hindu women do not generally take eggs.

Milk is rightly considered to be a perfect food, as it contains all the nutritive constituents in such proportions as are necessary for the maintenance of health and the growth of young

* "Eggs are admirably adapted chemically to supplement a food rich in carbobydrate, moderately rich in proteid but poor in fat. Such a diet is fouud in rice and many cereals, and the addition of eggs to these in the form of pudding makes a complete food." *Hutchinson.*

children.* It is rich in protein, fat and carbohydrate (sugar), but the excess of water (about 87%) contained in it makes it unsuitable for use by adults on an extensive scale. Moreover, in Calcutta and in other large towns, it is no exaggeration to say that it is a forbidden article of food on account of the dearness of its price. Pure milk is obtainable only with difficulty in the large towns of Bengal and its price keeps it out of the reach of people of moderate means. It is an indispensable article of food for children, but those in middle class families seldom get it in sufficient quantity and, therefore, suffer in growth and development. There was a time when milk used to be sold pure and cheap in Calcutta, and the poor people could count upon its forming part of their daily meal. The Hindus generally are very fond of milk and they would consider their meal incomplete unless it is supplemented by, however small a quantity of, milk or one or other of its various preparations like *dahi*, butter, *ghee*, *kheer* (thickened milk), *chhana* (fresh milk-curd) or any sweetmeat prepared from it, such as *sandesh*, etc. Rich people can afford to take, as they often do, one or more of the above articles (sometimes

* "It has been found that the casein of milk is the best absorbed of proteids and the fat of milk enters the blood quite as readily as the fat of meat."

"Milk seems to exercise a restraining influence upon putrefactive processes in the intestine."

"As an article of diet in disease, milk occupies a unique position. No single food is of so much value."—*Hutchinson,*

running to excess) regularly with their daily meals; those among them who are used to plenty of work or physical exercise seem to be all the better for it, but in the case of men of indolent habits, the consequence becomes apparent in their growing fat and their bodies becoming unwieldy and useless for any active work. The poor people, however, have to remain generally satisfied with a small quantity of *dahi* (curd) which is the cheapest of all milk preparations, and as it contains about 4.5 percent of protein and a good amount of fat, it makes up to a small extent the deficiency of these constituents in their rice-diet.

If meat, fish or eggs cannot be had in sufficient quantity and if milk cannot generally find a place in the Bengali dietary, what should we look to, to make up the deficiency of protein in our dietary? It appears to me that there is only one article of food to fall back upon, which, while cheap and growing in plenty, is richer in protein than either meat, fish, eggs or milk, which is free from the products of decomposition and disease-producing germs, and which, as it were by instinct, has been chosen as one of the principal articles of diet by both the meat-eating and meat-eschewing people of India from time immemorial. This is *dal* (pulses) of various kinds, which, weight for weight, contains more protein than either meat or fish. Fish, as I have said, contains about 78 percent of water and on an average, about 50 percent of

the stuff as bought in the market is waste in the shape of bones, scales and other refuse-matters. *Dal* contains about 12 percent of water only and in *dal* you have nothing to reject and so you get the full value of your good money by its purchase. It no doubt contains less fat than either meat or fish, but it is rich in both protein and starch. *Dal* is less stimulating than meat or fish, and being a dry substance, it does not undergo deterioration by keeping. Meat or fish cannot be kept for more than 12 hours in this country without perishing or deteriorating in quality. A seer of *dal* of good quality would cost you not more than two and half annas,* whereas the cost of a seer of meat would run to twelve annas.†

The objections generally urged against the use of *dal* are :—

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* The price has since gone up a little.—*EDITOR.*

†"The Edinburgh investigators were of opinion that in order to improve the dietary of the labouring classes, the following principles should be instilled into them :—

1. That a diet of tea and bread or of tea, bread and butter is faulty.

2. That the faults of the tea and bread diet can be corrected by the free use of meat, eggs or other animal food, but that this mode of correction is expensive.

3. That the faults can also be corrected by the free use of oatmea with milk or *by peas or beans without extra cost.*"—*Hutchinson.*

(1) That it is much less digestible than meat and much protein in it is lost by non-absorption.

(2) That it is deficient in fat.

(3) That a daily diet of *dal* is monotonous.

I shall briefly consider these objections one by one.

(1) As regards the first objection, I would point out that habit is a great factor in the digestion and assimilation of food. With Europeans who are unaccustomed to eat *dal*, it is quite possible that meat would agree much better than *dal*. But people who are used to taking *dal* as the Indians are, ought to have no difficulty in digesting it. The average time taken by meat for complete digestion is 3 hours, and *dal*, if properly cooked, would take about the same time. The reason why some people find it difficult to digest *dal* is because, as ordinarily prepared, *dal* is not properly cooked. The cooked *dal* should never have separate grains visible to the eye, and on being allowed to stand, should never show the watery portion distinct or separate from the substance itself. It should be of a uniform consistence and moderately thick; the grains should be thoroughly done up by prolonged boiling and vigorous stirring. *Dal* prepared in this way (*i.e.*, in fine division) is easily digestible and as much as 92 per cent

of its protein is absorbed into the system.* It is thus inferior to meat by 5 per cent only in respect of absorption. The people of Upper India cook *dal* in a much better way than the Bengalis. They eat it in larger quantity and find no difficulty in digesting it. In fact, many of the high caste Hindus over there do not touch meat or fish, but depend entirely on *dal*, *rootee* and milk or one or other of its products for the necessary supply of protein in their food. Our ladies would do well to see that *dal* is properly cooked and well-prepared. They will then find that it would sit kindly on the stomach of their children and would be tolerated by them in larger quantities and would supply them with more protein in the growing period of their life.

The average absorption of protein of *dal* if carelessly prepared is 80 per cent and of meat 97 per cent. But if *dal* is in a fine state of division, there is 10 or 12 per cent additional absorption, and this should always be borne in mind in preparing this dish in our houses. Even then, this loss by non-absorption of 10 per cent is more than compensated by its cheapness. Besides,

* "If properly prepared, the pulses (various forms of *dal*) are absorbed into the intestine very thoroughly. Thus the proteid of pea or lentil (*masoor*) is all taken up except about 8 or 9 per cent when 200 grammes (7 ounces) are given daily. The proteid of pulses, *if given in a fine division*, is capable of very good absorption, considerably better than gluten (protied of bread) when taken in the form of white bread."—*Hutchinson on Food and Dietetics.*

when meat forms the principal food, there are very few people who do not take it in excess, thus taking sometimes three or four times more protein than what is needed by the system. And is not this excess quantity wholly wasted? And is it not a much more serious waste both on economic and physiological considerations? The elimination of the unabsorbed protein of *dal* is after all a simple matter; it is only a mechanical process. But the excess of protein of meat absorbed in the body not only puts a very severe strain on the organs of elimination, but the uneliminated portion is the root-cause of many serious constitutional disorders. The ten per cent loss of protein in *dal* by non-absorption is, therefore, a matter of much less consequence than the retention of excess of absorbed meat in the system.

(2) The second objection urged against *dal*, viz., that it contains very little fat, is no doubt well-founded, Indeed, most of the *dals* do not contain more than 2 per cent of fat, whereas in meat, the average percentage of fat is 5. But this defect is made good, as is usually done in our household, by adding a quantity of oil (or *ghee* if one can afford to do it) to the *dal* during the process of cooking. This is a matter of common knowledge to any cook worthy of his hire, and thus people, though ignorant of the scientific principles of dietary, never cook their *dal* without adding some oil or *ghee* to it.

(3) The third objection that a daily diet of

dal is monotonous scarcely holds good if we only know how to make its various preparations. *Dal* could be taken in so many different ways and forms that, instead of becoming monotonous, it can be made into some of the most tempting dishes in our daily dietary. Of course, if one takes it day after day in one form only, namely as boiled *dal*, it loses its attractiveness and no wonder one would soon get tired of it. But none knows better than the Bengali housewife of the old school how this one article of diet could be turned into a variety of attractive dishes so tempting to the children and to whose charms, even older people are not insensible. At one time, it was considered to be an accomplishment, not to say a useful occupation, for the ladies of respected families to know how to make the various kinds of *burrees* from *dal*-paste by the simple process of drying by sun's heat. These enter into the composition of a large number of dainty dishes which are as nourishing to the body as they are agreeable to the palate. But times are changed. The ladies of the new school of thought would hardly care to learn, even if they have the leisure to do so, the very many niceties of art that are involved in the successful making of even one variety of those delightful preparations of which their grandmothers knew by hundreds, and as a consequence, the art of cooking attractive vegetarian dishes has almost become an unknown thing in Bengali homes, particularly in towns.

Then again, how many kinds of dainty cakes and sweetmeats could be prepared from the different varieties of *dal*! The combination of the nutrient constituents of food in some of these preparations is almost faultless. To mention a few only, e. g., *Kachoorees*, *Dalpurees*, the inimitable *Pithas* of the *Pous Parvan*, the *Dhoka*, the *Dalmoot*, the *Jhoories*, the *Bhajis* (vegetables with a coating of *dal*-paste fried in *ghee* or oil), the *Papars*, *Ras-burrhas*, *Jilabis*, *Moti-choors*, *Darbeshes*, *Bundias*, *Moong-laddus*, and a host of others of which *dal* forms the principal ingredient. Indeed, one has only to go to a resident of Upper India, or better still, procure an invitation to dinner from him in order to disabuse one's mind of the fiction that there is monotony in the *dal* diet. It is time that our Bengali ladies should turn their serious attention to this important question and introduce the very many dishes made of *dal* in the daily dietary, and I can confidently assert there will be no difficulty of any kind in taking *dal* in proper quantity when presented in so many agreeable forms.

It should be remembered that *dal* contains about 50 per cent of starch, so that when taking it along with rice or chapatee, the quantity of the latter could and should be advantageously reduced to a corresponding extent.

The way in which we usually prepare rice for our daily meals seems to be faulty, as thereby

we lose some of the nutritive principles present in rice. In the first place, the rice grains we buy are often too finely cleaned; the outer coating of rice contains some of the protein, the vitamines and nearly the whole of the salts, and, therefore, too much cleaning would remove those elements and make the grains poorer in nourishment. Then again, after we have boiled rice, we throw away the rice-water which takes away with it some of the nutritive principles from the grains and makes the prepared rice still poorer (about $\frac{1}{10}$) in protein and salts. The proper way to prepare rice is to cook it slowly in steam or boil it over fire with just sufficient quantity of water so as to cause the grains thoroughly soften and swell up without any excess of water being allowed to remain in the pot. This may be accomplished easily by a little practice. The rice is very conveniently and economically prepared in the "Ic-Mic Cooker" devised by the late Dr. Indu Madhab Mullick.

Khichery is made by boiling rice and *dal* together to which *ghee* and spices are added. A more general and extended use of *khichery* by the rice-eating people of Bengal will, I strongly hold, be a great improvement in their dietary. If potatoes and some green vegetables are boiled with *khichery*, it forms almost a complete and very palatable food. It is rich in protein because it contains *dal*; it contains fat, because *ghee* is added to it; it contains enough of starch and it is rich in salts and vitamines from the vegetables added

to it. Those who cannot afford to use *ghee* may add oil to it or the scrapings of the cocoanut kernel (or the milky juice pressed from the kernel) which will supply the necessary quantity of fat, the fat in cocoanut kernel being in this respect an excellent substitute for *ghee*. *Khichery* is not a heavy food as it is popularly believed to be, unless it is prepared with too much *ghee* and spices. It is very much liked by children, and should, wherever possible, constitute one meal for them for the day.

Rice in various other forms is used by the people of this country. Some of these are *chira* (beaten rice), *moori* (parched and puffed rice), *khoi* (fried paddy cleared of the outer tough shell) and *chalbhaja* (fried rice). *Moori*, *khoi* and fried *chira* are more nourishing than boiled rice and are more easily digestible, because the heat to which they are subjected during preparation dextrinises the starch of the rice grains and this helps digestion. Apart from the principal meal of which rice forms the chief food, it is resorted to in one or other of its various forms by the poor people for extra meals in the morning and sometimes in the afternoon. If parched rice (*moori*) is taken along with parched or boiled gram or peas (*chhola* or *matar bhaja* or *siddha*) and cocoanut kernel or sweetmeats prepared from cocoanut which are not costly, it would form an excellent all-round meal which, at one time, formed the only extra meal for all classes of the Bengalis. Such a

combination is excellent not only because it contains protein, fat and carbohydrates in good quantity but it has the merit of being singularly free from all kinds of impurities (adulteration), and is so cheap that it could be largely availed of by poor people. I feel no hesitation in strongly recommending the substitution of this healthy extra meal in place of the ordinary bazar sweetmeats or cheap *patties* and potato chops (generally made from stale meat and offals) which the boys of our hostels and messes are so fond of eating in the afternoon.

Wheat-flour should be substituted for rice for the evening meal as far as practicable. It contains nearly twice as much protein as rice and is also richer in fat and salts. The whole-meal flour contains more protein, vitamines and salts than fine white flour and should be used in preference to the latter whenever available.* The whole-meal flour helps the action of bowels and is, therefore, suitable for people who suffer from constipation. For this reason, good *atta* is preferable to fine flour (*Maida*). In preparing *rotees*, they should be rolled down quite thin and thoroughly baked on the oven, as otherwise many starch grains are likely to remain unbroken and these cannot be assimilated

* "The whitest loaf is the starchiest, the least rich in protein and, therefore, the least nourishing. 'Vitamines,' which are the nourishing constituents of whole-meal bread, do not exist in the white loaf."—*British Red Cross Society Hygiene and Sanitation Manual.*

in that condition and will give rise to indigestion. The starch in English bread (*Pawrotee*) is more thoroughly baked; good bread is, therefore, more easily digestible than *rootee*. Good brown bread is generally more nourishing than white bread. The afternoon light meal for our students may consist of bread and butter; a bread for $\frac{1}{2}$ *anna* and butter worth $\frac{1}{2}$ *anna* supplemented by a few plantains would make a good tiffin and should supplant the ordinary bazar sweetmeats purchased for the same value. Those who can afford to pay for one or two eggs (half boiled) or a couple of good *sandesh*, could add these to the bread and butter tiffin with great advantage, as this combination would considerably make up for the deficiency in protein and fat in their rice diet.

In hostels and messes, arrangements should be made to provide our boys with *chapatees* instead of rice for the evening meal. As wheat-flour contains nearly twice as much protein as that found in rice and as some *ghee* must be used for making the *chapatees*, the deficiency of protein and fat in the rice-diet would be somewhat made up in this way. The objection that I have heard frequently made to the supply of *chapatees* in hostels and messes is that sufficient hands are not available to prepare them for a large number of boys. The employment of a few extra hands is all that seems to me to be necessary for this purpose. The financial difficulty, if there be any, could be obviated by each boarder bearing a small monthly cost in the shape of the salary of the extra servants, and to my mind, there would be ample compensation for the little extra charge on this head in the improvement effected in the daily diet by the substitution of the more nutritious wheat-flour for rice.

Chhana (fresh milk-curd) is an excellent protein-food, richer in both protein and fat than meat and fish. It is a comparatively cheap article, the average price throughout the year being eight annas per seer (2 lbs.) An *anna* worth of *chhana* weighs 4 ounces and will give 24 grammes of protein and 21 grammes of fat, which is more than what one could get from any other food of the same weight and value. It may be taken in the afternoon with a little sugar or salt according to one's taste in that respect. *Sandesh* is prepared from *chhana*, and good *sandesh* is undoubtedly the best form of sweetmeat available in the market but it is costly. For an *anna*, you will get more food in *chhana* than in *sandesh* of the same value bought from the bazar.

For an *anna*, you can have a good quantity of *mohanbhog (halwa)*, a kind of Indian pudding prepared from *sooji*, *ghee* and sugar. One pice of *sooji*, one pice of sugar and half an anna of *ghee* will give you a plate-full of *mohanbhog*

(6 to 7 ounces) which makes a substantial tiffin, *sooji* being richer in proteid than either *atta* or white flour. The addition of a small quantity of the meal of parched gram (*chholar satoo*) will greatly increase its protein value.

Mangoes, jackfruits, pineapples, custard apples, *bael*, oranges and other kinds of fruits are sold cheap in their proper seasons and they should be taken in adequate quantity with one of the meals. Plantains are obtainable throughout the year and are rich in sugar (about 17%) and, therefore, nourishing. They are also the cheapest of all fruits and may be eaten regularly. Nuts are very rich both in protein and fat, and should, wherever possible, eaten in moderate quantity.

These are some of my suggestions for the improvement of the dietary of the Bengalis of of ordinary means. I have purposely refrained from making any reference to costly food, such as *loochies* and the many products of milk which find a prominent place on the tables of the rich people, as these are beyond the reach of the poor. They have their advantages when taken in moderation. Excess of such food, however, without regular physical exercise or labour, would give rise to corpulence and produce various diseases of mal-assimilation.

There are a few food-stuffs which may with advantage be taken in larger quantities than is done at present and which would certainly go

to improve our dietary in respect of its protein and fat value. Chief among them is the ground-nut or pea-nut (*Cheena badam*) which is extensively grown all over India (in Bengal, its cultivation is limited) for the sake of its oil. This is a nut which is extremely rich in protein and fat (24% of protein and 44.3% of fat). It may be that is does not agree with some people, specially when eaten in any large quantity, on account of the excess of oil it contains, but there could be no harm attending its use in small quantities along with other foods, and thus it would form a cheap source of supply of protein and fat in our daily dietary. The ground-nut oil is used as an adulterant of ghee and also as its substitute. In many parts of India, it is the chief source of fat in the dietary. In Bengal, mustard oil is used as a substitute for *ghee* by the poor people. So far as cost is concerned, the mustard and the ground-nut oils are nearly on an equal footing and no substitution of the former by the latter is needed in Bengal. But the introduction of the ground-nut itself in moderate quantity in our dietary would considerably make up the deficiency of protein and fat in it. The meal of the dry nut may be mixed with flour to increase both its protein and fat value. Baked groundnuts coated with sugar form a kind of palatable sweets for children.*

* Reference may here be made to a press-note issued by the Government of Bombay in November, 1917, which gives " an

The seeds of jack fruit (*Kantal beej*) deserve more than a passing notice as an article of food. Weight for weight, the meal of the seed is richer in protein than wheat-flour and any ordinary fruit or vegetable, and contains a good quantity of starch also. The seeds should be collected in the proper season, thoroughly dried in the sun and kept in stock for a whole year's consumption. In the Chota Nagpur division and some parts of Bengal, jack fruits grow abundantly and sell cheap; people of these places are afraid of eating them freely lest they get disorders of the bowels. The seeds may be collected at those places and a new business may be started in this way. They are quite good to eat, either boiled or baked, and form an excellent ingredient for a vegetable dish. They could be had cheap and they are very nourishing.

interesting account showing the possibilities of great improvement in the Indian ground-nut industry. After describing the commercial value of ground nut oil which is a most valuable substitute for olive oil, and import of which, owing to war conditions, is greatly reduced, the note shows that the resultant cake has a very high food-value, not only for cattle but for human beings also. Besides containing proteins, it contains a quantity of amino-acids. The Press-note describes how powdered ground-nut cake, mixed with dried milk, sodium carbonate and wheat-flour can be turned into a perfect food, approximating very closely a patent German food sold in India before the war at Rs. 6 per pound. This flour or food can be made in India at about one-twenty-fourth of the cost of the German product. The new flour makes a valuable food for invalids and for patients suffering from diabetes and allied conditions. It is also shown that there is absolutely no waste in the ground-nut industry. The paper-like husks serve the purpose of stuffing the source of cellulose for paper-making. The leaves and branches of the plant form an excellent cattle-fodder,"—*EDITOR*.

Cocoanut kernel was more largely used all over Bengal a generation ago than now. The fruits grow abundantly in the country and the kernel is very rich in fat. Cocoanut oil is very extensively used in South India for culinary purposes just as we use mustard oil in Bengal. In its appearance and composition, it resembles *ghee* more closely than any other vegetable oil. *Ghee* is differentiated from other edible fats and oils in that it contains the largest quantity of a special kind of fat called the Butyrate. The mutton-fat, tallow and lard contain only traces of this fat but cocoanut oil contains about $\frac{1}{4}$ the quantity found in *ghee*. It is, therefore, a good substitute for *ghee* in fresh condition when it emits no disagreeable smell. It is as cheap as mustard oil and could be had in almost any quantity. There is, however, hardly any necessity for substituting cocoanut oil for mustard oil in Bengal, so long as we get the latter in plenty and in pure condition, but cocoanut kernel may be very advantageously used with our meals in various forms, either by being cooked with *dal* or other vegetables, or the kernel itself being taken raw, or by its being made up into various kinds of sweetmeats which are much less costly than the ordinary bazar sweetmeats and certainly more wholesome. "Narikel Sandesh" is four times as cheap as the "Sandesh" that is prepared from fresh milk-curd (*Chhana*), and although it is not so rich in protein, it contains a large percentage of fat

and is thus well able to supply this deficiency in our dietary at a small cost. Cocoanut kernel should, therefore, find a wider place in the dietary of the Bengalis.

Among vegetables, potato is by far the best. Although it contains a very small amount of protein and fat, it is rich in starch, possesses certain important properties and gives a good amount of energy. It prevents scurvy (a kind of blood disease) and also helps to prevent fermentation in the intestines. It is also believed to have the power of dissolving uric acid and is, therefore, a valuable food in the constitutional disorder known as uric acid diathesis. About potato, Mr. James Long writes in his book on "Food and Fitness."—

> "The potato always stands first among the vegetables for the garden, and there is practically no other variety upon which life can be maintained in health and strength. When acting a Commissioner for the 'Manchester Guardian' during the famine in the west of Ireland in 1897. I had abundant opportunities of observing how well those who obtain a sufficient supply of potatoes were able to work and maintain physical proficiency. It has been shown by prolonged experiments in Denmark by Dr. Hindhead, the Chief of the National Nutrition Department, that man can perform considerable labour on potatoes with the addition of a small quantity of margarine and continue to do so for many months in succession."

Our young men are very fond of potatoes and it is only right that they should be so. From 8 to 10 ounces should be the average daily allowance of potato for a young man, and it should be taken baked, steamed, roasted or fried, in any one of which processes there is no loss of nutritive matter. Boiling causes loss

of a good proportion of its protein and salts. If boiled, it should never be done with the skin off.

The green vegetables which contain the largest amount of protein are the green peas and beans of various kinds. They should be largely used in the preparation of our vegetable dishes. Dried kidney-beans (*Barbati*) or gram or peas added to some of our vegetable dishes would considerably improve their protein value. The sweet potato and unripe plantains are also nourishing vegetables containing about 21% and 17% of carbohydrates respectively. Beet root, *ole* and *mankachu* contain a fairly large proportion of carbohydrates and are, therefore, much superior to ordinary green vegetables.

I have considered the dietary of Bengalis of ordinary means in respect of its deficiency in protein and fat value and I have suggested certain variations in it and recommended the addition of some comparatively cheap articles of food, rich in protein and fat, to make up the deficiency. In doing so, I have steadily kept in view the economic side of the problem, as the suggestions cannot otherwise have any practical value. It is no good recommending to a poor man meat, milk, eggs and other kinds of costly food which he cannot afford to buy. A poor Indian must have to depend mainly upon *dal* for obtaining the necessary amount of protein. A wholesome dietary, I need hardly repeat,

while containing the requisite quantities of protein and fat, must at the same time be such as to suit the pocket of every person of small income resorting to it.

This economic aspect of a national dietary is a question of vital importance to the poor of every nation and of every country all over the world. I wish Europe had learnt to appreciate the value of *dal* as a good substitute for meat; the poor people there would do much better socially and economically if meat is partially, if not wholly, replaced by pulses in their daily dietary. And much of the present difficulty * of procuring enough meat for the combatants and the serious trouble of regulating the daily meat-rations for the civil population would have disappeared, if England had, before this, recognised and adopted the general use of *dal* as a protien-food of high value. And in

* This paper was written at the time of the great European War.—*EDITOR.*

Some idea of the present difficulty in getting meat in European countries may be formed from the following statements taken from an English daily paper :—

"Bacon and eggs as the *piece de resistance* of a dinner in a good restaurant or club would have been considered unthinkable. It is by no means unthinkable now but extremely common. The nation could and would willingly submit to still further reduction of its meat-rations, if the present scale interfered with the requirements of the boys at the front."

"So far as we know, horse-flesh has not hitherto entered into the diet of the inhabitants of the United Kingdom, not even excluding the popular sausage. But according to a letter written by an English woman in Holland and published by the *Express* yesterday, the only meat obtainable in that country is horse-flesh, and it costs 5*s*. 6*d* a pound."

support of my contention, I may be permitted to quote here the observations of Dr. Hutchinson, one of the greatest English authorities on Food and Dietetics, deploring the practical exclusion of pulses from the dietary of the poor in England. He says :—

"As a cheap and efficient method of supplementing the deficiency of Nitrogen (i.e. proteid) in a purely vegetable diet, the use of pulses *(dal)* is strongly to be recommended, and it is a pity that they are not more largely taken advantage of by those to whom economy is of importance, for unquestionably pulses are amongst the cheapest of foods, and a given sum will yield more protein if invested in them than in any other way."

I have stated that, besides helping the growth of the body and repairing the tissue-waste caused by work and exercise, there is another very important function of food, namely, the supply of heat and energy to the body. The greater the loss of heat from the body and the harder the work one has to do, the larger must be the quantity of food required for the supply of both. Now, all food-stuffs do not yield the same amount of heat and energy. The foods that produce the largest amount of heat and energy are fats and oils, and these are, tharefore, largely consumed by people living in cold climates. Next to them are the carbohydrates (starch and sugar), the protein-foods such as meat and fish, unless they contain much fat, occupying the lowest place in the scale. Fats generally yield nearly $2\frac{1}{2}$ times more heat and energy than starch or sugar and, therefore, this kind of food is the

best for giving us strength and sustenance for our work. The popular idea that meat is an energy-giving food is erroneous. * It does give some energy no doubt, but in this respect, it is very inferior to fats and also to starch and sugar. It is pre-eminently a muscle-forming food ; it assists the growth and repairs the waste of tissues caused by work.

It has been ascertained by actual experiments how much heat could be produced by one and the same quantity of different food-stuffs. This is expressed in calories, a calorie being taken as the unit of measurement of heat. Now, we know that there are various forms of energies, such as heat, electricity, chemical energy, mechanical energy etc., and that one form of energy could be converted and is convertible into another. Thus heat can be converted into mechanical energy (as in propelling engines), and mechanical energy into heat again. In our body, the muscles and other tissues as well as the food circulating in the blood are being slowly burnt by the oxygen taken in by the lungs during the process of respiration and heat is thereby produced. Part of this heat is used up for the maintenance of the body-temperature at the normal standard, the rest is converted into mechanical energy

* "At one time, it was believed that proteins were the chief sources of muscular energy, while the carbohydrates and fats acted as fuel and maintained the body-temperature. We now know this is a mistaken view —*Hutchinson.*

which enables us to perform work involving voluntary muscular exertions, such as walking, running and doing the day's work, and it also helps the internal organs, such as the heart, the lungs etc., to perform their regular work which does not depend upon our volition.

It has been ascertained that for a moderate amount of exercise and work, a man requires 2800 to 3000 *calories* or *units of energy*, and this he must obtain from his daily diet. A dietary containing all the different nutritive constituents of food in necessary quantity and in proper proportions and which would supply a person with the required units of energy for both internal and external work, could be worked out by arithmetical calculation. Thus a man in good health and performing ordinary labour would require a daily diet which should furnish him with at least 1250 grains of muscle-forming element (protein) and 2800 units of energy. I subjoin a table in which the amount of muscle-forming element (protein) and units of energy obtainable from different food-stuffs purchased for an *anna* have been worked out. I hope it will be of use in making a selection of food-stuffs readily obtainable in the market for the construction of a wholesome diatery for people of ordinary means.

TABLE I.

Amount of muscle-forming element (protein) and energy (calories) obtainable from an *anna* worth of various food-stuffs.

(Calcutta price.)*

Food-stuffs.	Weight in ounces. (After deducting the waste)	Protein in grains (calories)	Units of energy
Rice	14	364	1372
Flour (Wheat)	12	577·5	1200
Bread	8	280	560
Dal	12	1260	1104
Fish	2	150	80
Meat	2	175	150
Eggs	3	170	210
Milk	8	140	160
Dahi (Curd)	9	182	163
Potato	16	140	560
Mustard oil	8	0	1776
Ghee	1·25	0	227
Butter	1·5	6·5	296
Chhana(Freshmilk-curd)	4	391	304
Ground-nut	8	840	914
Sugar	6	0	690

Calculating the proteins, fats and carbohydrates in terms of Nitrogen and Carbon, we find that on an average, a Bengali adult in good

* This table and table II were calculated on the Calcutta price prevailing in 1917. It will have to be slightly modified according to the prevailing market price of the time.—*EDITOR.*

health and doing a moderate amount of work, intellectual and physical, and weighing about $8\frac{1}{2}$ stones (a maund and half) would require such a diet as would yield about 250 grains of Nitrogen (a little less than what is required by Europeans), 4500 grains of Carbon and from 2800 to 3000 calories (units of energy) in 24 hours. He would require more food when doing a greater amount of physical exercise or when his weight is greater.

The following dietary would give him every one of the above things in the required amounts, if he is a pure vegetarian or if he cannot afford to provide for meat, fish or milk in his diet :—

TABLE II.

Food-stuffs	Quantity in ounces	Nitrogen in grains.	Carbon in grains	Calories	Cost. Rs.	As	P.
Rice	8	28	1400	784	0	0	6
Flour(Wheat)	10	78	1660	1000	0	0	9
Dal (pulses)	4	64	624	345	0	0	7
Potato	6	9	270	150	0	0	5
Other vegetables	4	7	80	40	0	0	3
Mustard oil	1	0	219	138	0	0	3
Chhana (fresh milk-curd)	4	64	108	304	0	1	0
Goor (brown sugar)	2	0	178	115	0	0	3
Salts (spices etc.)	1	0	0	0	0	0	6
TOTAL	40	250	4539	2896	0	4	6

Such a dietary, on an average, would cost four annas and six pies only. The cost, however, may be further reduced by substituting *dal* for *chhana*, provided the power of digestion is good.

I have said that the value of a food-stuff is estimated by the amount of the muscle-forming element (protein) it contains and the units of energy it yields. Bearing this in mind, the table no. 1. shows that for the same money-value, viz., one *anna*, which is within the means of ordinary people, the largest amount of energy as well as of the muscle-forming element could be obtained from *dal*, and *dal* only. Meat and fish come very low in the scale in these respects. Further, it has been noted that as regards our staple food, i. e, rice, though it yields a large amount of energy, yet as it contains only a small amount of protein, it should be taken combined with or supplemented by any of the other food-stuffs which are rich in protein. Of these, *dal*, *chhana*, meat, eggs, fish and milk are generally used and from the table above referred to, it will be seen that for the *same money-value*, the largest amount of protein is available from *dal*. Next comes the ground-nut and *chhana*. Meat, fish, eggs and milk, on account of their dearness, can never from the principal protein-yielding food for poor people. *Chhana* is an article easily procurable, easily digestible, and for the same price, yields more than double the amount

of protein and energy than that obtainable from meat, and nearly $2\frac{1}{2}$ times as much protein and 4 times as much energy as would be yielded by fish. It is a pity that *chhana* is not more largely used than at present to make up for the deficiency of protein and fat in our ordinary diet. It should be freely used by our students for their afternoon meals.

For obtaining the necessary quantity of fat, the continued use of mustard oil which is the prevailing practice all over Bengal is all that is necessary. *Ghee* is and will be used by rich people, but mustard oil is not at all an unsatisfactory substitute for *ghee* and is much cheaper. A person would require daily at least 1 oz. of oil or *ghee* independently of the amount contained in the various kinds of food-stuffs forming his daily diet. Now, 1 oz. of *ghee* would cost about an *anna* but the same quantity of good mustard oil could be obtained for a pice only. And mustard oil has always taken the place of *ghee* in the diet of our poor people without any prejudice whatsoever.

In concluding, let me say that I have approached the consideration of this question with no prejudice against meat. But if, in working out a general dietary for those with whom this paper is primarily concerned and to whose religious feelings and social and economic conditions one must give due consideration, I have shown any bias against any particular kind of food, I trust it, will be laid, not at the

door of any pre-conceived notion on my part but to the compelling logic of facts which has prevailed with me and which, I am sure, will tell its own tale to any one who will give to this subject the consideration it deserves. From all points of view, rice or wheat-flour, combined with *dal*, oil, salt and vegetables in their proper proportions (what we popularly call *Dal-bhat or Dal-rotee*) would form the daily dietary of the majority of the Indian people and righty it should. Only the people of Bengal should take a little less quantity of rice and a little larger quantity of *dal* and some quantity of wheat-flour in place of rice. Such a diet has the sanction of age to recommend it and is one that agrees with the habits of the people and the natural conditions of the country, and on which even Science would pronounce its benediction. What more could the most exacting authority on food expect? Those who can afford to do it, could add, as they often do, meat, fish, or milk or one or other of its various products to such a dietary which would make it not only agreeable but advantageous in many respects.

The importance of physical exercise as a valuable adjunct to food in the growth of the body and maintenance of health, should never be lost sight of, nor the dignity of labour underrated. If you want to make your body supple and strong, if you would escape the odium that is too often levelled against the people

of this country for the stout ness of their frame and the indolence of their habits, if you want to keep your head above the surface in the keen struggle for existence that is going on around you, why then, you must have a sound mind in a sound body. And how else could you hope to attain to this physical fitness except through the judicious intermingling of the right kind of food in right quantity and healthy work and exercise?

The larger the quantity of food you take, the more work and exercise you must perform to enable that food to be completely used up in your system, and the less work you do, the less must be the quantity of food for the day. This is a truism the importance of which is seldom realised, not only by the people of this country but by those of other countries as well. And as a consequence of its breach, we see complaints arising from mal-nutrition and mal-assimilation of food such as dyspepsia, diabetes, gout &c., from which a very large number of men suffer. To those who suffer from these disorders, my advice is that they must learn to know how to regulate their diet according to their needs, and that what they require for regaining their health in not the doctor's prescription but plenty of work and exercise with judicious regulation of diet.*

* The author was favoured with the following comments on this paper by the late Sir Gooroo Dass Banerjee, Kt., M.A., D.L., PH.D.—EDITOR.

"I have read with much interest your admirable paper entitled "Some Practical Hints to improve the Dietary of Bengalis." The subject is one of vast importance. It concerns both the rich and the poor. The great deficiency of nutritive ingredients in the Bengali's dietary tells materially on his body and indirectly also on his mind, and if the defect is not cured in time, things will go from bad to worse. But the problem of improvement is as difficult as it is important and the difficulty arises from the poverty of the people and is enhanced by religious sentiment excluding several articles from the dietary.

It is matter for no small congratulation that this important and difficult subject is taken in hand by a writer of your ability and attainments who is not only a learned physician and chemist but has made the food-question his lifelong study, who is gifted with a rare power of lucid popular exposition of recondite truths of science, and who is animated by an earnest desire to serve his countrymen. And this paper, as might be expected, is well worthy of its author.

It does not indulge in vain recommendations which the poverty of the people would render impracticable or which their sentiments would make unacceptable. It treats of the subject in a simple but methodical manner, considering first of all in detail the articles of the ordinary existing dietary and pointing out its defects, and it then suggests simple practical modes of removing those defects. The guiding principle throughout kept in view is not to add much that is new, but to utilize and turn to the best advantage all that is old, by easily practicable and improved modes of preparation, and to avoid all that is rare and costly and avail of everything that is cheap and easily procurable.

Certain popular ideas regarding the exaggerated importance of meat have been sought to be corrected and the true physiological action and value of different articles of diet have been explained in language as simple and free from technicality as could be desired.

This valuable paper should be circulated as widely, and the suggestions contained in it followed as fully, as possible."

The Milk-Supply of Calcutta: Its Hygienic, Commercial and Social Aspects*

I. Supply and Quality.

Chief Sources And Quantity.—The supply of fresh milk for the town of Calcutta may be stated to come from three principal sources. About 300 maunds are daily brought into the city by the E. B. S. Railway at Sealdah and about 100 maunds jointly by the E. I. and the B. N. Railways at Howrah. About another 300 maunds reach the town from its northern and southern suburban areas and of these two, the area including Chitpore, Cossipore and Dum-Dum situated in the northern suburbs of Calcutta is the more important. The third source of supply is in the city itself, i, e., in the gowala-bustees, in the few dairies and in private houses situated within the jurisdiction of the Calcutta Municipality.

Five years ago, Dr. Pierce, the then Health Officer of Calcutta, estimated that about 2000 maunds of fresh milk formed the average daily consumption of Calcutta. One-third of this was

* A paper read at a meeting of the Social Study Society on 17th August, 1918, and published in the Modern Review, September and October, 1918.

brought into the city by the different railways and carriers by foot, another third was produced in the town itself in the licenced cow-sheds and dairies, and the rest obtained from cows kept in private houses ostensibly for the use of the owners, but sometimes really for sale of milk without coming into the notice of the authorities.

It is very difficult to obtain even approximately accurate figures for the total consumption of milk in Calcutta and the quantity obtainable from each of the above-mentioned sources, but one thing is quite clear, viz., that an efficient official control can be kept only on the quantity that reaches the town by railways, and that it is very difficult to check the supply brought into the city by itinerant vendors who come from many directions and by numberless pathways. It is still more difficult to calculate the quantity produced in private houses which roughly constitutes, according to Dr. Pierce, about a third of the whole supply of the town. This shows that a very large quantity of milk is produced and consumed in Calcutta under conditions which are practically outside the control of the Health Department of the city.

Taking the population of Calcutta to be 900,000,* the average daily consumption of milk per head in the city roughly comes to about one-twelfth of a seer, i. e., about $2\frac{1}{2}$ ounces which appears to be rather a low estimate. As adults form the bulk of the floating population of

* According to the last Census Report, the number stands at about 10,772,64.—*EDITOR.*

Calcutta and as they, except in certain communities, generally use very little milk, partly from habit but mostly from inability to buy such a costly article of food, the consumption of the bulk of the milk is confined to children and invalids, and to one's regret, its quality does not come up to the mark.

Milk : Cow's and Buffalo's.—The milk as we get it in Calcutta is derived partly from cows and partly from buffaloes. Almost every gowala in the city and in the suburbs keeps a few she-buffaloes along with cows and he sells the milk obtained from this source sometimes as buffalo-milk, but more often, diluted with water and with or without admixture of cow's milk, as cow's milk of pure quality. The average quantity of milk given by a Bengal cow is about a quarter of that obtained from a she-buffalo, and as the fat in buffalo-milk is nearly double of that in the cow's milk, it admits of considerable dilution with water before it falls below the *standard* of pure milk ordinarily accepted in this country. Buffalo-milk may indeed be diluted half and half with water and still the minimum limit of fat, viz., 3 per cent, will not be transgressed.* Thus the gowala makes a very large profit by selling buffalo-milk considerably diluted with water as pure cow's milk. I shall have to say something about the difference in the composition of the two kinds of milk when

* The *standard* has since been raised to 3.5 percent in the amended Calcutta Municipal Act —*EDITOR.*

I come to discuss the minimum *standard-values* of the purity of milk.

Quality of the Supply—The present milk-supply of Calcutta, to describe it in the mildest term, is most unsatisfactory. It is not only poor in quality, but it is exposed to so many unfavourable conditions during production and transport that it is an absolutely unsafe article of food for the public unless certain precautions are taken to make it harmless.

According to the social organisation of the Hindus, the gowalas or Aheers (as they are called in Bihar and in the U. P.) form a separate caste which is a complete unit by itself in all its social relations and obligations. They rear cattle and are responsible for the supply of all milk and some of the important milk-products to the community. This confinement of different trades to different castes of the community has no doubt undergone some change with the spread of English education in town areas, but in the far off village communities all over India, the state of things prevails almost in its primitive condition. It is, however, not uncommon to find nowadays in some places, people of one caste following the occupation of another, and now and then, we meet with educated men of higher castes starting dairies and selling milk and milk-products as a means of living. The gowalas, however, still hold practically the whole milk-supply of the country under their control.

The trade-honesty of the gowalas has never been of a high order. Some of them openly declare that they would be infringing their caste-rules if they would sell milk without admixture with water, however small the quantity may be. There is a very amusing story told of this class of people which I take the liberty to relate here. A certain Indian king wanted to test the honesty of the milkmen living in his capital and issued an order that on a certain night, every gowala should supply him with a pitcher of pure milk which he required for some religious ceremony fixed for the next morning. It was so arranged that each milkman bringing his supply would pour it into a pipe leading to a reservoir placed inside a locked room, so that nobody could see, touch or pollute it. The night was dark and each gowala brought in his quota and poured it into the pipe leading to the reservoir. In the morning when the room was unlocked, the king found that the reservoir contained pure and simple water only and no milk in it. It so happened that each gowala thought, with the characteristic mentality of his caste, that as others were sure to obey the order of the king and bring pitchers of pure milk, he would be quite safe if he brought a pitcher of water only and pour it into the common reservoir, and the king would not be able to detect the trick. The story illustrates what class of people we have to depend upon for the supply

of one of the vital necessaries of life and it will be long before we can expect to see any material change in their psychological condition.

The condition of things in other countries, though not so bad as in India, is nevertheless far from satisfactory. In spite of the advance of education, the vigilance of sanitary authorities, the strict operation of the Food and Drugs Act and the influence of a strong public opinion, much of the milk as supplied in England, is hardly of the desirable quality. This has recenty been the subject of enquiry by high sanitary authorities and the result is not very encouraging. It is as much a question of adulteration there as of sanitary purity, and Dr. Savage remarks that "the idea that the average cow-keeper will, of his own accord and without outside pressure, supply clean milk instead of a manure-laden one, cannot be seriously entertained." The final plea taken by milkmen is the same here as elsewhere, viz., that they produce milk in the same condition as their fathers did and that what was good enough for their fathers is good enough for them also. The sophistication of milk, although it is not such a universal practice compared with India, prevails to a notable extent even in England.

I have had occasion to examine samples of milk supplied to some of the Government hospitals in Calcutta and Howrah and I am glad to say that it has improved during recent years. Whereas the percentage of samples of adulterated milk supplied to some of the hospitals was 83·6 in 1913, the figure for 1916 was 37.6, and in 1917, all the samples analysed were found to be of good quality. This is very satisfactory, as milk forms a most important diet for the sick, but unfortunately the same cannot be said regarding supply of milk for the general population of Calcutta. The figures of analysis made in the laboratory of the Calcutta Corporation will give you a fairly accurate idea of the quality of milk supplied to the public of Calcutta. I am greatly indebted to my friend Dr. S. B. Ghosh, Chief Analyst to the Corporation, for his kindly supplying me with the figures in the table given below :—

TABLE I.

Year.	Number of samples examined.	Percentage of adulterated samples (watered).
1913	593	40.1
1914	496	50.0
1915	490	40.2
1916	403	26.0
1917	436	40.6

The samples were collected by Food-Inspectors from the different stalls for the sale of milk in the town as well as from the quantity brought by railways and itinerant vendors. The above table gives you information regarding the number and quality of the samples of milk analysed in the Corporation Laboratory during

the last 5 years. It must be stated here that a sample of milk is pronounced to be of good quality when it contains not less than 3 percent of fat. Now, 3 percent of fat, in my opinion, is too low a *standard* of purity for milk yielded by Indian cows and many adulterated samples would pass as pure if judged by this minimum *standard* of purity. I shall have occasion to discuss later on this point when I consider the question of *standards*. During 1905 and 1906, altogether 521 samples of milk were examined in the Municipal Laboratory, and of these, 73 samples, i. e., only 15 percent were found to be free from adulteration. The rest were mixed with water varying from 10 to 80 percent. From the above table, it will, however, be seen that the percentage of adulterated samples examined at the Municipal Laboratory from 1913 to 1917 varied from 26 to 50. This shows an apparent improvement in the milk-supply of the town as compared with that of some of the previous years. It must, however, be borne in mind that during the last 5 years, some limitation, I am told, had to be placed on the collection of samples; for during this period, the gowalas began to take advantage of the loop-hole in the Municipal Act of Calcutta and used to dispose of a good many samples, declaring them as "watered milk," and consequently, these were not collected. The lower percentage of samples found adulterated does not, therefore, necessarily indicate that there has been in fact an improvement in the quality of the milk sold in Calcutta.

Recently, during a visit of the Chairman of the Corporation to the Jorasanko milk-market, he found that apparently good milk was being sold there at $2\frac{1}{2}$ seers per rupee. This was on the occasion of an important Hindu festival when the price of milk and milk-products always goes up very high. Under his orders, 48 samples of the best milk available were collected from the different milk-stalls in Calcutta (Jorasanko, Baitakhana, Sealdah, New Market and a few other places) and analysed in the Municipal laboratory. It was found that the average percentage of fat in the samples obtained from Jorasanko was 4.9; from the New Market 4.2, and from other places, a little above 5 percent. From the remarks of the Health Officer on the samples thus collected, it appears that good milk could be had at times at Jorasanko even at 8 seers for the rupee, at Baitakhana six seers, and at the New market $4\frac{1}{2}$ seers, and that during the time of Hindu festivals, the price goes up very high, specially at Jorasanko, milk being sometimes sold there at eight annas per seer. It is difficult to believe that pure milk could be had in Calcutta at any time at more than 4* seers per rupee and the price is often much higher. It may be that when the supply is much above the demand in these markets, milk, being a perishable article, could be had

* Good milk is now being sold in Calcutta at $2\frac{1}{2}$ seers per rupee —*EDITOR.*

at cheaper rates occasionally. And one might reasonably conclude from the high percentage of fat found in many of these samples (about 5 per cent) that the milk sold in some of these markets is chiefly buffalo-milk diluted with water.

Bacteriological Examination.—A very large number of samples were also bacteriologically examined in the Calcutta Municipal Laboratory. It may be stated here that in the most favourable circumstances, freshly-drawn milk does not show more than 500 bacteria in 1 cubic centimeter. Under ordinary conditions, however, the number of bacteria is much larger but they ought not to exceed 6000 in 1 c.c. The number of bacteria found in 1 c.c. of milk sold in market places in Calcutta varied from 1,000,00 to over 3,000,000 and the bacilli of the *colon* group (which indicate contamination with fæcal matter) were found to be present even in as small a quantity as $\frac{1}{1000}$ part of 1 c.c. This shows the dangerous character of the milk-supply of Calcutta as a carrier of such infectious diseases as enteric fever, cholera, dysentery, etc. As regards tubercle bacilli, their presence was rarely detected.

Properties of Milk.—Milk is the secretion of the breast of female mammals for the nourishment of their offspring. It may be considered as the most "complete" of all foods, as it contains all the nutritive principles, viz., proteins, fat, carbo-hydrate, salts, vitamines and water in

proper proportions for the growth and sustenance of young animals for a certain period of their existence. It is a white opaque fluid, sometimes with a tinge of yellow, denser than water with which it is perfectly miscible. The density or specific gravity of pure cow's milk varies from 1,029 to 1,034, the density of water being taken as 1,000; it is decreased by milk being mixed with water and increased by abstracting cream from or by adding sugar to it. All these practices are resorted to by the artful gowala to get adulterated milk pass for pure milk. Its whiteness is due to fat in fine division being suspended in water. If you examine a drop of milk under the microscope, you will see innumerable small rounded globules of fat of varying sizes covering the whole field. It has got a feeble alkaline reaction and in the case of certain animals, it possesses a faint odour of the particular animal yielding the milk.

When fresh milk is allowed to stand for sometime in a cool place, a thick yellowish layer is found to float on the surface which mostly consists of the fat of the milk mixed with a certain amount of its nitrogenous constituents. This is what is called "cream", and when removed, the milk becomes much poorer in quality, and such milk is known as "separated" milk. The gowalas take full advantage of this property of milk. They draw the milk generally at 3 o'clock in the morning and allow it to stand for 2 or 3 hours

in a cool place and then, after removing the cream and adding a little water to the "separated" milk, sell it to their customers as pure milk. The fraud cannot be detected by the Lactometer (an instrument for determining the density of milk) which is the only instrument in the hands of the householder to test the purity of the sample. The removal of cream raises the density of the milk and the addition of a little water brings it down again to normal density. Thus the indication of the Lactometer in such a case is valueless. Separated milk, when not watered, cannot strictly be called "adulterated", but it is not genuine milk and the sale of it as pure milk brings the vendor within the penalty of the law.

We shall limit our consideration to cow's and buffalo's milk only in this paper. The following table gives a comparative average composition of the two kinds of milk and shows at a glance the enormous difference in their fat-constituents :—

TABLE II.

Kind of Milk	Percentage.				
	Water	Protein	Fat (Butter)	Carbo-hydrate (Milk-sugar)	Salts (Mineral matter)
Cow's	86.4	4.0	4.5	4.4	0.70
Buffalo's	81.8	4.52	8.2	4.6	0.88

From the above table, it will be seen that there is about 13.6 percent of solid matter in

cow's milk and nearly one-third of it is fat. In buffalo's milk, the solid matter is much larger, being about 18.2 per cent and a little less than half of it is fat. I have already mentioned that much of the milk sold in Calcutta is buffalo-milk diluted with water, and if the purity of milk is judged on the sole consideration of the percentage of fat contained in it, the buffalo-milk may be diluted with more than equal part of water and may still be passed as pure cow's milk. Fortunately, other facts are taken into account to judge of the purity or otherwise of a sample of milk and this enables one to detect the fraud and bring the offender to book.

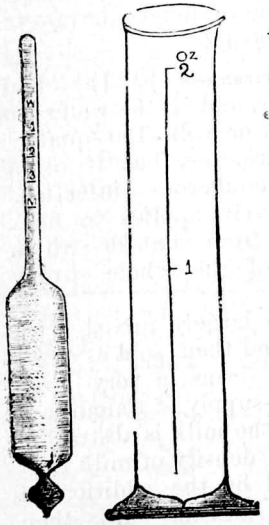
Adulteration : Nature of Adulterants.—(1) The chief adulterant of milk is water, and if the water so added is from a dirty tank or well, the quality of the milk not only deteriorates but it often becomes the carrier of dangerous infectious diseases. This remark mostly applies to milk brought into the town from outside which constitutes about one-half of the whole supply of Calcutta.

(2) Cow's milk is also largely mixed with buffalo's milk, watered, and then sold as cow's milk. This kind of milk forms a very large proportion of the total milk-supply of Calcutta.

(3) Part of the fat in the milk is abstracted in the form of cream, the density of milk thus raised is reduced to normal by the addition of requisite quantity of water and the milk then sold as pure milk.

(4) The most common method of adulteration is to water the milk and then raise the lowered density by adding brown sugar to it in the form of sugar-cakes (BATASA). You will see this being practiced by the gowalas in the streets of Calcutta every morning on their way to the houses of the customers. This kind of adulteration baffles detection by the Lactometer.

(5) It is believed the watered milk is sometimes thickened with some kind of cheap starch or chalk, but such fraud is not often practised.



Lactometer.

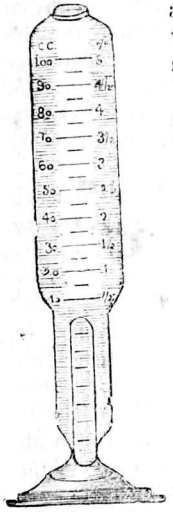
Detection of Adulteration.—Without going into the details of milk-analysis, I propose to briefly mention a few practical tests which would go to help the householder to ascertain roughly the purity or otherwise of the sample of milk supplied to him.

The instrument most commonly used for testing the quality of milk by the householder is the Lactometer. In the case of pure milk, when the instrument is allowed to float in the fluid placed in the cylender, the surface of the milk should be

on a line with the lowest mark "M" on the stem of the instrument or very near it. The higher marks, viz, 3, 2 and 1, roughly indicate 25, 50 and 75 percent respectively of water added to the milk. A little correction is needed for the temperature of the milk, as the instrument is standardised at a definite temperature, but this is hardly necessary, for, after all, it is a rough method and the reading gives sufficiently accurate information for all practical purposes. Our gowalas, however, know all about the Lactometer and they adulterate their commodity in such a way that the indication of the instrument becomes perfectly valueless. After removing some cream from the milk, the "M" mark rises above the surface and then by adding water until the "M" touches again the surface of the milk, the gowala sells his adulterated commodity as pure milk without fear of detection by the Lactometer. In such a case, however, the milk becomes thinner and any experienced eye would find out the fraud. Then again, if the milk is watered and then some cane-sugar is added to it, the density is raised and such milk would also defy the test by the Lactometer. This fraud which is usually practised by the gowalas, could be detected by a simple test for cane-sugar which I shall presently describe.

There is another instrument called the Lactoscope, which gives direct information about the percentage of fat in the milk. The

instrument is so graduated that if you take just sufficient milk to fill up the lower and narrower part of the instrument and then add water until the black marks on the procelain stem fixed in the centre of this part become just visible, the percentage of fat in the sample is indicated by the figure against which the surface of the diluted milk rests. This is a very handy instrument, much more reliable than the Lactometer and enables you to detect the watering of the milk or removal of cream from it.



Lactoscope.

For the detection of added cane-sugar in the milk, it may easily be found out by taking a little milk in a test-tube, adding a small pinch of resorcin and a small quantity of hydrochloric acid and heating the test-tube over a spirit-lamp, when, if cane-sugar is present, the milk would turn deep red. The apparatus required for this test are simple, viz., a test-tube and a spirit-lamp only and the few chemicals required for the test could be got from any druggist's shop at a very small cost and they would keep for any length of time. The test is quite easy of application and helps to detect the fraud which is commonly practised by the gowalas.

If any kind of starch is added to the milk to thicken it, its presence could at once be detected by putting a drop of milk under the microscope and noticing its peculiar-sized striated granules. Starch can also be detected by boiling the milk and adding to the cooled milk a few drops of tincture of iodine; the development of blue colour would indicate the presence of starch.

Adding powdered chalk to milk to thicken it is a clumsy trick and could easily be detected by adding a few drops of hydrochloric acid to the milk when it will froth.

II. Hygienic and Commercial Aspects.

Measures recommended for improved and increased supply.

So long as the present conditions of the housing and milking of cows will continue, the public of Calcutta can not avoid drinking more or less dirty milk.

Sources of Infection.—The cow-sheds in this town are generally filthy, over-crowded, ill-lighted and ill-ventilated. The floors often remain thickly covered with a mixture of decomposing dung and urine and the animals stand, sit or lie down there for 24 hours. A thick crust of dried excreta could always be seen on the udders and bodies of the animals which are seldom properly washed. An offensive smell could always be noticed on entering

a cow-shed. Swarms of flies and mosquitoes complete the picture of an average cow-shed in a 'gowala bustee' in Calcutta. Milk is drawn morning and evening in these dirty insanitary holes by men wearing dirty clothes and with unwashed hands and it is collected in dirty vessels. The rubbing of the hands on the dirt-laden udders of the cows during milking and the incessant lashing of tail by the animals to drive off flies and mosquitoes cause many a particle of excreta to drop into the freshly-drawn milk and make it unsafe and unfit as human food.

The enforcement of the Municipal regulations in Calcutta has undoubtedly improved to some extent the state of matters so far as the housing of cows is concerned, but the men, the animals and the milk-pots do not show any appreciable sign of improvement in their sanitary conditions. Perhaps the deep-rooted idea among the Hindus that cow-dung, far from being filthy, is a purifying substance, has much to account for the indifference of the gowalas to take proper precautions against the contamination of milk by the filth of the animals. Then again, the fact that hands are universally used in this country for taking food makes people think lightly of the general habit of touching food by the hand, and this might account for the practice which the gowalas invariably follow of dipping their dirty hands (with the measuring pot) into the

milk-can without for a moment realising the objectionable features of the act. Moreover, the cleansing of a vessel with water, irrespective of its source and character, is usually considered sufficient to ensure its cleanliness. These ideas and practices have grown hoary with age and cannot be easily eradicated. They are largely responsible for the contamination of milk in the gowala's house ; they can be removed only by education and training.

The milk is transported in wide-mouthed open vessels to the place of sale or delivery and there it remains uncovered until disposed of. Dust and dirt of all kinds easily have access to it, flies from doubtful quarters come and sit upon it and offensive-smelling gases get absorbed by it. In order to prevent spilling during transport, green date-palm leaves or bundles of straw are often put into the can and this constitutes an additional source of infection.

Model Dairies.—To give the gowalas an opportunity to learn how to produce clean milk, model dairies on a small scale should be started in Calcutta under the direct management of the Corporation and the local gowalas should be encouraged to visit these places and see with their own eyes the work done there in detail. Prizes in the shape of money or cattle should be annually given to men who keep clean cow-sheds and clean animals and who produce milk under most cleanly conditions. The Municipality can run

stalls of its own to sell the produce of these model dairies (which should form in the main so many training schools for the gowalas) and there will be no dearth of local market for the produce. The Bagbazar Model Dairy started by the Calcutta Corporation did not succeed because the authorities wanted the gowalas to keep their cows in it which they would not agree to do for obvious reasons. The cows are usually looked after in the houses of the gowalas by their women-folk ; this could not conveniently be done in a public dairy and hence no gowala could be induced to take his cows there. He would perhaps gladly come and learn the improved methods of producing milk in a model dairy but would not, on grounds of economy, convenience and social customs, remove his cows there.

It is no doubt very desirable, on both sanitary and economic grounds, that all cow-sheds and dairies should be removed outside the town as has been suggested by Major Matson and the Chairman of the Calcutta Corporation in their able reports on the subject of milk-supply in Calcutta, but I am afraid that it will take a long time before this scheme can be completely carried out. In the meantime, we must not sit idle and allow the existing unsatisfactory state of things to continue. We must educate the people concerned in the trade how to produce milk under the best hygienic conditions and the model dairies suggested above will go a great

way to help us in attaining this object. It cannot be denied that there are serious social and financial difficulties in the way of the gowalas leaving their family homesteads and settling themselves in strange places outside Calcutta to carry on their trade. It will take some time for them to get over their scruples and difficulties and to understand and appreciate the undoubted advantages of removing their trade outside Calcutta, as advised by experts. But I believe that the moral and educative influence of the model dairies I have suggested, will help a great deal to solve the difficult problem of the final emigration of the gowala population from the city into the country.

Grazing Ground.—It is often and often found that as soon as a cow gives up milk, the gowalas try to sell her to butchers to avoid the expenses of maintaining the animal until her next milking period and to make room for another milch-cow in his already over crowded cow-shed. As they generally buy cows of good breed yielding a fairly large quantity of milk, such practice causes serious waste of cattle of good milking capacity and stops perpetuation of their species. The gowalas are compelled to take to this wasteful practice for financial reasons only, and it could be prevented by devising some

[*] Many gowalas resort to the cruel practice *phooka* to obtain a larger supply of milk and this leads to barrenness of cows which are then sold to butchers.—*EDITOR.*

means by which they could maintain the cows at the least possible cost and inconvenience during their dry period. This can be effected by starting grazing farms by private enterprise, where these cows can be taken and cared for till their next milking period at a reasonable cost. Attempts have been made by certain philanthropic societies to start a few grazing farms near Calcutta. These, I am told, have not proved successful and I have grave doubts as to whether such an undertaking will ever succeed unless managed on sound business methods and principles. Here is a field open to my countrymen for launching a new business with moderate capital which may ultimately develop into a prosperous concern.

A new joint-stock-company has, I understand, just been started under the name "The Cattle Preserving Company Ltd." at 10, Old Post Office Street, Calcutta, with the object of supplying pure milk at a comparatively cheap rate in the city. They also propose to provide for extensive grazing grounds near Calcutta where cattle will be taken care of at a small cost during dry period.

Diary-Farm.—To ensure pure milk-supply in Calcutta on a large scale, one or more big dairy-farms should be started outside Calcutta on the joint-stock-company principle. A large piece of land should be secured where the cattle will be located, fodder-crops will be cultivated, and sufficient ground set apart for the grazing

of the cattle. It should be near a railway station to ensure quick transport of the produce and should be under the management of an expert assisted by one or more competent veterinary assistants and chemists. It should be provided with a laboratory for both chemical and bacteriological analysis of milk, a veterinary hospital and laboratory for treatment of sick animals, diagnosis of cattle-disease and manufacture of vaccines, and should possess adequate arrangements for pasteurisation of milk. All milk should be produced there under approved sanitary conditions, pasteurised, and then sent out for sale in sterilised locked cans with taps for drawing out the milk. Besides milk, the manufacture of other milk-products, such as cream, butter, fresh milk-curd (chhana), curd (dahi), condensed milk and dried milk, for which there is such a large demand among the Indian community, may be attempted, if surplus milk is available.

It has been suggested that a dairy-farm of this kind should be organised by the Calcutta Corporation and conducted under its direct control. While admitting that there are certain advantages in this proposal, I am doubtful whether it could be run on the same economic scale as by a well-organised private company, and thus one of its chief aims, viz., the cheapening of the supply, will not be attained. More-over, the present time is very opportune for a private enterprise of this

kind. The national consciousness in regard to the economic back-wardness of the country has been roused and a general awakening is visible from one end of the country to the other. Educated India has begun to recognise the stern fact that for the salvation of the country, the methods hitherto pursued will not do, that commerce and industry must be developed and that he himself has to play a very important part in the economic evolution of the country. He has begun to appreciate the benefits of the co-operative system of working and has learnt to value the dignity of labour. He has demonstrated his capacity as an organiser in various departments of life, and he had never before put a stronger faith in his own capability and honour. Now, a little help from the Government in the way of advice, guidance and special training will make him fit to conduct even big enterprises with credit to himself and prosperity to his country. Before starting a dairy-farm, he must get himself thoroughly initiated into the work by serving necessary periods of apprenticeship in Government and other well-conducted dairies. Many of our industries have failed because of the lack of expert knowledge and of business training and capacity in those who were responsible for their management and any new industry started should keep clear of these pitfalls. Capital for the enterprise will not be wanting, if capable workers are available. A private company starting a big dairy-farm

will certainly be at a greater disadvantage in the beginning than one started by Government or by a rich Municipality like the Calcutta Corporation with so much wealth, resources and prestige at their command, but I have no doubt that with the friendly help of Government and the Calcutta Corporation, it will before long turn into a prosperous concern and will succeed in solving satisfactorily the difficult problem of the milk-supply of Calcutta.* In the interest of the development of trade by private enterprise, I do not like to see such a dairy-farm started either by the Calcutta Municipality or by Government, as either of them will be a formidable competitor and the natural growth of private enterprise will suffer much. I shall have to speak a few words later on about the establishment of smaller dairies on co-operative lines.

Improvement of Breed.— To ensure an increased supply of milk and at a cheaper rate, the first and the most important measure, therefore, is the establishment of dairy-farms outside Calcutta, and the next measure is to improve the breed of the cattle which can only be done successfully in these big dairies. The

* We are informed on the authority of the "Property" of Calcutta that Bombay Municipality has guaranteed for a number of years a certain percentage on the capital invested by persons or Companies establishing dairy-farms on approved lines and is willing to subscribe, if necessary, a portion of the capital required, on the condition of its nominating a certain number of Directors of the Company. We should like to see the Corporation of Calcutta take action on similar lines.—*EDITOR.*

breed of Bengal cows has much deteriorated and this, combined with the slaughter of prime cows of other good breeds after two or three lactation-periods, famines and floods,* and the prevalence of epidemic diseases† among the cattle is telling heavily on the milk-producing capacity of the country. Besides, thousands of cattle are poisoned annually in India by a certain class of people called Chamars who kill other people's animals for the sake of their hides only. The diminution of the cost of maintaining cows during their dry period would, it is hoped, prevent much of the fearful waste of valuable cattle-life, and for this, the starting of grazing farms under private enterprise and the rearing of cattle under proper sanitary arrangements are necessary. We shall require the help of Government for securing land for dairy-farms and grazing grounds under the operation of the Land Acquisition Act and I have no doubt that such help would readily be forthcoming, if the projects prove to be practical and financially sound. We shall also require help from Government in the way of expert advice in the matter

* There occurs a very large loss of cattle-life in different parts of India during famines and floods. In Rajputana alone, when famine visited that province in 1900, about 7,000 000 cattledied, and in Guzrat, about 500,000.—N. *N. Gangopadhyaya's Progress of Agriculture in India.*

† The number of deaths from epidemic diseases was 187231 in 1912-13, and 193744 in 1913-14. This has probably been underestimated judging from the returns of export of hides during the same period.—*N. N. Gangopadhyaya's Progress of Agriculture in India.*

of cattle-breeding, production of fodder-crops and prevention of cattle-disease etc., and also in the way of giving facilities to our youngmen for admission into Government dairies for practical training in dairy-work. Government help will also be required for obtaining concession from the different Railway companies for transport of milk at reduced freights. We shall require the help of the Calcutta Municipality for providing good stalls with suitable sanitary arrangements in different parts of Calcutta at reasonable rates of rent for the sale of milk, and for obtaining facilities for speedy transport of milk.

The other° measures recommended are:—

(1) *The Calcutta Municipal Act should be so ammended as to penalise the sale of any milk other than pure.**

(2) *All milk sold in Calcutta should be brought under the complete control of the Municipality. This will necessitate the establishment of a larger number of milk-markets at convenient places in Calcutta and the increasing of the present Inspecting and Laboratory staff of the Corporation,*

(3) *A thorough and more frequent inspection of cow-sheds in Calcutta and a more rigorous application of the Municipal regulations in regard to the housing of cows and production and sale of milk.*

° This has since been done in the new Calcutta Municipal Act.—*EDITOR.*

(4) *Prohibition of slaughter of milch-cows as far as practicable.*

(5) *Concerted action with Suburban Municipalities for the exercise of an effective sanitary control over the production of milk for supply in Calcutta.*

(6) *Establishment of Model Dairies in Calcutta for the training of gowalas.*

Co-operation in Milk-supply.—The scheme for starting big dairy-farms outside Calcutta may take time to mature and it will be sometime before such farms can be put into a proper working order. In the meantime, we can develop the system of milk-supply in Calcutta on *co-operative lines*. Already work of this kind on a small scale has been taken up by the Department of Co-operative Societies in Calcutta under Mr. J. T. Donovan, I. C. S. Small co-operative societies, of which the milk-producers are themselves the share-holders, have been started in villages near about Calcutta. The initlal expenses for starting such a society is small, Rs. 100-200 being required as the working capital, and this is being raised jointly by the Co-operative Department and the share-holders themselves. The system has good many advantages and is susceptible of considerable expansion. In villages, the owners of cows are generally the cultivators of the soil and cattle-keeping is only of secondary importance to them, their primary occupation being agriculture.

These people are as a class so disintegrated and illiterate that they are ignorant of the ordinary principles of trade. This village milk-trade, therefore, like all other indigenous industries is degraded and handicapped by the evil forces exercised on it by the "middle-men" and the *Mahajan*. The actual producers are bound by contract to supply milk at a low unremunerative rate to the "middle men" who bring the milk within easy reach of the citizens of Calcutta. The owners of the cattle thus get a mere subsistence allowance for all their labour and no wonder they take no interest in the welfare of the cattle. Consequently, there has been a steady decline in the number as well as in the milk-producing capacity of cattle, while the few "middle-men" are growing rich at the expense of the actual producers. It was about a year ago that the question of the supply of pure milk in this city came to be considered by the Co-operative Department. Many proposals were made, and after well-matured consideration and on expert advice, the Department arrived at the conclusion that the only way of supplying pure milk to the city which would at the same time benefit the milk-producers themselves, was to eliminate the "middle men" altogether and to engender a sense of enlightened self-interest in the producers by organising them into Co-operative Societies. These societies are on share-basis. The shares are purchased exclusively by the milk-producers who are the members of these

societies. The entire management of the Association is in the hands of the milk-producers themselves under the supervision of the Co-operative Department. The producers sell their milk to the Association individually at a fixed price and it is disposed of in the city collectively by the Associatien under the supervision of the Co-operative Department. In addition to the remunerative rate (Rs. 7 to 7-8 per maund of 50 seers), the milk-producers get a profit by way of bonus. The milk is sold in Calcutta at the rate of Rs. 10 per maund of 40 seers.* There are at present 8 such co-operative societies in the Baraset subdivision in the 24 Parganas, and they send out collectively 8 maunds of milk daily to Calcutta for sale. These societies are so many training grounds for the milk-producers who acquire first-hand knowledge of the art of management of the milk business. The direct benefit which the milk-producers derive by such organisation evokes in them a sense of enlightened self-interest and of mutual self-help. To prevent adulteration, the Societies have employed milkers who are generally men of probity, and the purity of milk is tested before sale both at the office of the Societies and at the milk-depot. After a careful working for a period of six months, it is found that the individual members of the Societies who are themselves the producers, have made a profit of 10 per cent. over what they used to get from the "middle men,"

* It is being sold now at 3 seers per rupee.—*EDITOR.*

the cattle which were generally neglected are being well-cared for and that a sense of consciousness that cattle is a part of their wealth and that "cattle like children are all the better for individual attention" is apparent among them. Further, this system of keeping a small number of cattle in separate sheds under the individual care of the cultivators indirectly serves the purpose of segregation during outbreaks of epidemics.

The speedy supply of milk thus produced to the consumers in Calcutta is at present a difficult problem and may be solved by the Calcutta Corporation coming to the help of these Societies and the citizens of Calcutta by lending a motor lorry to fetch the milk and distribute it in the city as speedily as possible. The Co-operative Department has reluctantly to refuse registration of many such societies on account of this trouble and I would earnestly appeal to the Corporation of Calcutta to give this matter their best consideration. These Societies may be expected to pay a reasonable portion of the cost of maintaining the lorry for the present, but it is hoped that as they grow, they will be able to defray the whole expenses of transport by themselves.

I am indebted to Babu Nirendranath Basu, Inspector of Co-operative Societies, for information on this subject.

The following interesting note dated the 12th August, 1924, on the supply of milk to Calcutta on co-operative basis has been kindly furnished by Babu Akshoy Kumar Bose, B. A., Inspector of Co-operative Societies, Calcutta.

"It will perhaps be a welcome surprise to many to know that the city of Calcutta is regularly being supplied daily with about 50 maunds of pure cow's milk. The history of organising the first Co-operative Milk Society is really interesting reading and will be found in Mr. Donovan's paper on "Co-operation and Milk-Supply of Calcutta" published by the Bengal Co-operative Organisation Society. It reveals how an accidental beginning helps to lay the foundation of a big organisation for serving a useful social purpose. In the course of his tour in rural areas, not far away from Calcutta, Mr. Donovan came across a Mahommedan cultivator who had boycotted the local *goala* for the latter's refusing to come to one of their marriage-feasts. The Mahommedans of the village wanted to supplant the goala by one of themselves for taking the village milk to Calcutta. In this, they were not successful and were losing. Mr. Donovan at once seized the opportunity and accompanied the cultivator to his village and arranged for the sale of the milk in Calcutta, under the *aegis* of the Co-operative Department. Thus the first Milk Society was started sending to Calcutta only 15 to 20 seers of milk a day. This happened in 1915.

"The success of this society acted as an 'eye-opener' to the neighbouring villagers and Co-operative Milk Societies began to spring up in the area. There are now 54 Co-operative Milk Societies federated to the Co-operative Milk Societies Union in Calcutta, the office of which is located near Sealdah. The average membership per Society is 45.

"Milk is brought down to Calcutta by rail in different hours of the day and also at night. At present, the supply arrives at 8 A. M., 9 A. M., 9-30 A. M., 5 P. M., 7 P. M. and 12-30 A. M. The milk which is brought at 9-30 A. M. and 12-30 A. M. are pasteurised before distribution. The milk arriving in other hours are distributed as soon as it arrives.

"The Co-operative Milk Societies Union supplies daily the Calcutta Medical College with about 16 or 17 maunds of milk, the Carmichael Medical College with about 2 maunds, the Mayo Hospital with about 1½ maunds, the Grand Hotel with about 5 maunds, the Spences' with about 1¼ maunds, the Bristol Hotel with over a maund and also to a few other hotels.

"The Milk-Union has also under its direct management 5 selling depots in Calcutta located at the New-market, Sealdah, College street market, Hatibagan, and Shambazar. The average daily consumption in the New-market depot is 4 maunds, at Sealdah 1½ maunds, at the College Street market one maund, at Hatibagan 30 seers and at Shambazar 12 seers.

"Besides these depots which are under the direct management of the Union, there are some other milk-selling depots in Calcutta which work on Agency-system taking their supplies from the Milk-Union. There are such depots at Maniktola, Bhowanipur, Kalight, Kidderpore, Beadon street, Badurbagan, Landsdowne Market and Taltola. These work on commission basis or on suitable rates. These Agency-depots together sell milk to the extent of about 16 maunds a day on an average.

"There are also a few sellers of the Bhadraloke class who supply milk from house to house and work on commission system.

"The Milk Societies purchase milk from the members at a slightly higher rate than the prevailing local rate which varies in different Societies and is usually at Rs. 7/- per maund. Similarly, the Union purchases from the Societies at a rate a little higher that what they purchase from their members. This rate is usually at Rs. 7/8 per maund, though of course it varies in different seasons of the year. It should be noted here that the local weight is greater by 25 % than the standard weight, the local weight of 40 seers being equal to 50 seers of the standard weight. Payment is made once a month through the Union's own Supervisors who go out to the villages to make payment on the spot. The staff of the Union consists of 3 Supervisors besides salesmen and office-establishment. The Union is under the direct supervision of an Inspector of the Department.

"As regards the disposal of surplus milk, there is practically no surplus in the *dry* season. But in the other season, the quantity of surplus sometimes rises even upto 25 maunds a day. The disposal of surplus in this season becomes a problem with the Union. At present, it has to be sold in the market at a sacrifice rate. Sometimes also, *ghee*, cream, *dahi* and *kheer* are prepared with this surplus. The largest surplus is recorded in the months of April, May, and June.

"From the beginning, the Union has been attentive to the *improvement of cattle*. It purchased for the use of the Societies two pedigree bulls, one of which died about a year ago. The Societies are gradually appreciating the usefulness of these bulls. Since the start of the Societies, there has been distinct improvement in the method of keeping and feeding cattle. Efforts are also being made for the joint purchase of fodder.

"The Union declares *bonus* to the Societies out of its net profit as disclosed in the Government Audit based on the quantity of milk supplied by each Society to the Union. Last year, a bonus of As 2 per maund was declared."

Pasteurisation vs. Boiling.—The process of pasteurisation consists in heating the milk in a suitable apparatus at a temperature of 60° to 65° C. for about half an hour and cooling it quickly thereafter. This will kill all ordinary bacteria but will not destroy *sporing* forms and *spores*. The one form of bacteria (Bacillus Enteritides Sporogenes) which is responsible for many cases of food-poisoning * is not affected in its spore-form by the temperature of pasteurisation; these *spores* can only be killed by *boiling the milk* (100° C.) Too much reliance, therefore, must not be placed on the process of pasteurisation. The only safe course to make milk free from infection is to boil the milk. This is universally practised in Indian houses and should never be omitted in European households. There is no doubt a difference of opinion regarding the digestibility and absorption of boiled milk. It has been held by some that boiled milk is less easily digested and absorbed than raw milk and the drinking of such milk might give rise to certain deficiency diseases, such as scurvy etc. The entire absence of scurvy among the Indian people who always drink boiled milk militates against the latter theory. Then the first part of the theory also has been questioned by high authorities on dietetics. I shall quote for your information an extract from a standard book called "The Food and the

* See in this connection the author's article on the Bhowanipore Food-poisoning Case, Vol. I, page 298.—*EDITOR.*

Principles of Dietetics" by Robert Hutchinson who is a high English authority on the subject. He writes :—

"The comparative absorption of boiled and unboiled milk has been the subject of a good deal of experimental investigation. Taking the whole of the evidence, the conclusion seems to be justified that just as boiling does not appreciably diminish the digestibility of milk in the stomach, so it does not to any important extent interfere with its absorption in the intestine. One need have no fear, therefore, that the advantages of boiling are purchased at the cost of any noteworthy diminution of digestibility or absorption."

I have already mentioned that too much reliance should not be placed on the process of pasteurisation. Even when it is thoroughly done, the milk cannot be considered as wholly free free from infection. One of its great advocates, Dr. Savage, in his excellent treatise on "Milk and the Public Health", while recommending the process, makes the following important observations as regards the difficulty in carrying it out :—

"Much commercial pasteurisation is inefficiently done. It is a procedure involving an accurate adjustment of time and temperature, and frequently being apt to be performed by careless and unskilled persons, the so called 'practical man,' it is very insufficiently done. It is likely to be more harmful than beneficial unless the practice is rigicly supervised and the conditions under which it may be employed regulated."

If so much difficulty is experienced in working out the process in England, its chances of success in India are very doubtful and "would lead to neglect of general sanitary precautions under the belief that it would be an efficient substitute for cleanliness." Under the circumstances, in

India, the boiling of milk is the simplest and the safest procedure for its perfect sterilisation and should never be abandoned or neglected.*

Hutchinson expresses himself very strongly on the habit of drinking raw milk. He says that "there is every reason to advocate the habitual application of one or other of these methods (pasteurisation or boiling) to milk before it is consumed as food; and one looks forward to the day when the drinking of raw milk will be considered as barbarous a custom as the eating of of raw meat is at present."

Fixing the Standard-values of Purity.—I shall now briefly consider the question what should be the minimum *standard-values* of the purity of cow's milk in India. At the present moment, there is no authoritative *standard*, and in cases of dispute in Courts of Law, the English *standard* of 3 percent of fat is generally accepted. But any one who has even a limited experience in the analysis of milk in this country will unhesitatingly pronounce this to be too low a *standard* for milk of Indian cows and that its acceptance would largely encourage the practice of adulteration. The percentage of fat in the milk of even ordinary Indian cows seldom falls below 3·5 and in the case of well-bred and well-cared-for animals, it is often above 5. Only recently,

* Recent experiments show that there is some *loss* of *vitamines* when milk is subjected to boiling. The presence of infective germs in ordinary Indian milk should, however, outweigh all other considerations.—*EDITOR.*

40 samples of milk of known purity from Bengal and Nagora cows were analysed at the Municipal laboratory in Calcutta, and in one of them only, the percentage of fat was 3·5; in some samples, it rose as high as 6, but the average was 5·2. If 3 percent of fat is accepted as the minimum *standard* of purity, most cow's milk in Calcutta would allow from 30 to 40 percent adulteration with water and yet pass as pure milk under the eye of law. From my own experience extending over 32 years in the Government laboratory in Calcutta, I can safely say that we would not go wrong if we fix 4 percent as the minimum limit of fat in pure cow's milk, and there is enormous weight of evidence to show that it would not be a high limit at all. In order, however, to proceed cautiously in the matter, I would for the present recommend *the fixing of 3·5 percent of fat* and *8·5 percent of "solids other than fat" as the minimum standard values of the purity of cow's milk*,* and any sample of milk showing a lower percentage should be considered as adulterated. Major Matson, in his admirable report, has dwelt upon this question and has condemned the 3 per cent *standard* as too low. He also recommends 3·5 percent of fat as the miuimum *standard* of purity for cow's milk, and the Health Department of Calcutta has adopted this *standard*.

* This has since been adopted in the Amended Food and Drugs Acts for Bengal and Calcutta.—*EDITOR.*

In framing a *standard* for this country, there is one difficulty, namely, that we have to deal with two kinds of milk in the Indian market, viz., cow's milk and buffalo's milk, the percentage of fat in the latter, as I have mentioned before, being nearly double of that in the former. The fixing of two *standards* would be difficult of operation in practice and cannot, therefore, be recommended. Pure buffalo-milk should contain not less than six percent of fat, and not less than 10 per cent of "solids other than fat." By accepting the *standard* I have recommended viz., 3·5 percent of fat and 8·5 per cent of "solids other than fat," buffalo milk with about 25 percent of water added might pass for cow's milk, but this need not cause any apprehension, as such milk may be considered as equivalent to good cow's milk.†

The absence of an authoritative *standard* of purity for milk, ghee etc., in this country is causing much inconvenience, and prosecutions for adulteration may fail on this account. In Courts of Law, the contending parties set up figures which are sometimes as widely divergent as the poles, and the Courts might accept the English *standards* which are hardly applicable to conditions prevailing in India. At the present time, each analyst in giving his opinion on the quality of a sample of ghee, for example,

† This difficulty has been removed in the Amended Acts b fixing a separate *standard* of purity for buffalo-milk.—*EDITOR.*

follows his own standard based on methods of analysis and results which are not always uniform and, therefore, somewhat arbitrary.

The appointment by Government of a committee of experts to consider and fix the minimum *standard values* of the purity of important food-stuffs such as ghee, milk, mustard oil etc., is a matter of urgent necessity. Unless some such step is taken, there is every likelihood of much contest taking place in Courts of Law between the analysts of the opposite parties and it will be difficult for the Court to decide which figures to adopt to satisfy the ends of justice. The work of the committee of experts will be laborious and may take some time for its completion. They will have to procure samples of known purity from all parts of the country under varying conditions, have them carefully analysed by standard methods, and the minimum *standard values* of purity fixed on the results of such analysis. However, the work will have to be done in the interests of justice and of the supply of pure food-stuffs, and the sooner it is taken up by Government, the better for all parties concerned.

Social Aspects.

The importance of the effect of a plentiful supply of milk on the social well-being of a community has never been so fully realised

as now. Milk is an indispensable article of food for children. The child draws his whole nourishment from milk alone; his health, growth and strength suffer irretrievably if the supply is short in quantity and poor in quality. The child is but the parent of the man, and the debility and stunted growth of both body and mind in childhood as the result of underfeeding, reflect strongly on the future man-hood of the nation which is thus put under considerable physical and intellectual disadvantage in the general struggle for existence.

The fearful loss of life in the present European War has caused the people of the West to concentrate their attention deeply on the problem of protecting childlife from preventible death and securing its welfare. The claim of poor expectant mothers and babies for a plentiful supply of good food at the cost of the nation is now being more and more recognised.

Infant Mortality in Calcutta. The terrible mortality prevalent in Calcutta among children under one year of age is attributable to a combination of causes one of which undoubtedly is want of proper nourishment both of mothers and babies due to extreme poverty. Bad midwifery, insanitary condition of houses and their surroundings, immaturity of parents due to early marriage, ignorance of the simple rules for the preservation of health etc., are

some of the causes to account for the high rate of infant mortality in the town of Calcutta, but the inability to procure sufficient nourishment for the mother and the baby and the feeding of the child with unsuitable food which it cannot digest, are no doubt strong factors in increasing the death-rate of children under one year of age. This is a matter for serious reflection by the leaders of the community. If we want to prevent this cruel waste of child-life in this city, then along with the adoption of sanitary measures and the provision of skilled medical help to poor women during confinement, we must see that the expectant mothers get sufficient amount of nourishing food, and their babies the required quantity of good milk. The Corporation of Calcutta and the philanthropists of the city must join hands and work together in giving effect to this proposal.

Dr. H. M. Crake, the Health Officer of Calcutta, attributes a good proportion of infant-deaths in this city to the bad health of mothers who cannot get sufficient nourishing food owing to poverty. Thus he observes in his Annual Report for 1915-16 :—

"More than one-third of the total deaths amongst infants occurred during the first week of life. The great majority of the deaths (1210 out of 1603) were due to the premature birth and debility at birth. The causes of this literal decimation of the infants born in Calcutta must obviously be almost wholly maternal. Poverty and the consequent lack of good nourishing food is probably one of the chief factors. When the expectant mother is not only underfed but is also subjected to the strain of pregnancy and lactation at short intervals, and constantly exposed to insanitary surroundings as a *purdanashin*, puny stickly babies, who only survive a few days, are the inevitable result."

Ante-natal Clinics. The Health Officer of Calcutta has thrown certain valuable suggestions which would lead to reduction of the heavy loss of infant life in Calcutta. Some of these measures have proved successful in combating the evil in Europe and America and there is no reason why they should not be tried in Calcutta, although certain modifications appear likely to be required in their application in this city to suit the special conditions of the social life of the people. The chief object of these measures is to improve the health of the poor expectant mother by bettering her sanitary surroundings, giving her expert advice in matters of domestic hygiene and in her preparation for the confinement-period, placing skilled medical help at her disposal during and after child-birth, and providing for better nourishment both for her (before and after confinement) and for her baby during the first few months of its life. I cannot do better than quote Dr. Crake's observations on this point. Says Dr. Crake—

"The spread of education and the constantly increasing scope of preventive medicine in other countries has resulted in the establishment of "*ante-natal-clinics*". Lady Health Visitors visit expectant mothers and encourage them to visit the clinics, particularly if there are any suspicious symptoms, such as albuminuria, œdema, etc. Philanthropic agencies co-operate and poor women are assisted to secure good nourishing food. Working on these lines, much could be done for the poor women of Calcutta if they could be induced to visit such a clinic. This branch of preventive medicine, however, is a comparatively recent development, and there is little or no hope of success for any such institution in Calcutta at the present time."

Baby Clinics. As regards the saving of baby-life, he says :—

"Whilst proper attendance at birth would save scores of mothers and hundreds of babies, there is no provision for trained supervision during the first few critical weeks. The remedy in a community with more advanced ideas on preventive medicine, is of course the establishment of "*Baby Clinics*" which have been so successful in Europe. These institutions are in charge of highly trained nurses and regular clinics are held by honourary physicians, usually specialists in diseases of children. Mothers are encouraged to bring their babies at regular intervals about once a week. A careful examination (of which weighing is an important part) is made and full and detailed instructions on the feeding, clothing and rearing of infants are given to the mother. A most essential part of the scheme is a milk-depot, where not only pure sterilised milk can be obtained, but where carefully prepared "humanised milk" graduated to meet the requirements of each individual case, is made up according to the physician's directions. Here again, philanthropic societies join with the municipal authorities, and there is a fund for providing milk free of charge to the poor unable to pay for it. Such is the brief outline of the scheme adopted by many municipalities at Home."

Lady Health Visitors and their Work. Cannot some thing of this kind be done for the city of Calcutta? The *purdah* system and the ignorance of the people will, I am afraid, stand for a long time against general success attending establishment of "*ante-natal clinics*" in Calcutta, but one or two may be established for the benefit of the poor Anglo-Indian, Indian Christian and a few other communities which do not observe the *purdah*. In the case of Indians, very few *purdah* women, Hindus or Mahomedans, in their delicate condition could be induced to visit these "*mothers' clinics*" and get benefited by the advice and help given there by experts. And

here I venture to suggest a modification of the system which, if accepted, would go a great way to solve this difficult problem. I would have the poor expectant mothers in the city regularly visited in their own homes by our Lady Health Visitors, helping them to improve the sanitary condition of the house and its surroundings, advising them how best to make themselves fit for the coming critical period, supplying them with medicines and milk free of charge where necessary, providing for skilful medical help during confinement, and looking after the baby for a few weeks after its birth.

There is already a good nucleus for such work in the Calcutta Municipality. The present organisation of Lady Health Visitors and nurses under them should be further expanded and employed solely for this purpose, so that every poor woman in the city is able to take the fullest advantage of this system for the preservation and betterment of infant life in Calcutta.

Free Supply of Milk. The question of supplying good nourishing food to the poor mother is more complicated in India than in Europe owing to religious and caste restrictions. Soup and other kinds of ready made food are supplied to mothers in Europe. Such a procedure cannot be adopted in the case of the Hindu community here. The only food to which

objection will not be taken is milk, and this should be supplied to deserving cases free of charge.

Milk depots should either be opened by the Calcutta Corporation or suitable arrangements should be made with respectable vendors for supply of pure milk to mothers and babies free of charge on presentation of certificates issued by the Lady Health Visitors who may be depended upon to issue such certificates in deserving cases only.

For free distribution of medicines and milk, the Corporation must be assisted by public philanthropy, and I have no doubt that if the scheme is well-understood, there will be no lack of funds to support it.

As regards "*Baby clinics*"*, these may be started as an experimental measure. It may be that in the beginning, the results will appear disappointing. Here, however, we shall not meet with the same difficulty as in the case of "*ante-natal clinics*," for babies may be taken to these places by elderly female members or the male members of the family who may be expected to carry out the instructions of the experts. Here also certificates for free distribution of milk may be given by the medical officer in charge according to the requirements of each case, and these will be attended to when presented at the milk-depot.

* A few such Clinics have since been started in Calcutta with encouraging results.—*EDITOR*

In this connection, I am glad to quote the valuable observations of Rai Bahadur Dr. Haridhon Dutt, one of the leading members of the Corporation of Calcutta, made in an important paper on "Infant Mortality and Maternity Home" recently read by him at a meeting of the Calcutta Medical Club :—

"The work done by the three Health units (each unit consisting of of a Lady Health Visitor and a few nurses under her) in Calcutta has been found to be useful. If, however, any appreciable reduction in infant mortality is to be secured, the baby-welfare-work has to be further extended and provision should be made to meet the urgent needs of the poor mothers and their infants. Pure milk and in winter, warm clothing for infants with have to be supplied. The important question of giving nourishing food to mothers during lactation will have to be solved. Calcutta is not lacking in pious and rich persons. Why should not they come forward and combine and form charitable institutions to do this blessed work for the amelioration of the poor?"

The recent remarks of Sir Robert Armstrong Jones, M. D., made at a meeting of the Royal Society of Arts are also worth quoting in this place. He said :—

"Next in importance to the marvellous changes brought about in the habits of the people consequent upon the War, has been the fuller realisation of the pressing importance and the sacredness of child-life, and the lesson taught is the precious care that should be exercised in its protection and its supervision." He further observed that "mothers should receive by State Control, proper, prompt and skilled attendance during and after confinement : infants should receive treatment until the child goes on to the school register, and the home should be visited by authorized persons so as to foster a public opinion educated to set a high value upon infant life and not to tolerate its neglect. The rebuilding of our manhood is only possible when the dignity of motherhood has become the corner-stone of our public faith and creed."

Milk in Indian Dietary. Besides being children's food, milk is depended upon as the principal source of protein and fat in the dietary of a very large proportion of the Indian adult population. In every country, there is a certain number of people who do not take flesh food but live upon vegetable diet supplemented by milk and milk-products. In India, the number of vegetarians is, I think, considerably larger than in all the countries of the world put together, and it is no exaggeration to say that milk forms with them an indispensable article of diet. The Jains, the Vaisnavas, a large number of Hindus belonging to higher castes and particulary their widows, do not eat flesh in any from at all. Milk and its products, such as butter, ghee, fresh milk-curd, *dahi* and sweets made from milk, in one or other form, are consumed by Indian vegetarians, and even those that take meat and fish, daily use milk in some form or other in limited quantities. The importance of milk in the Indian dietary cannot, therefore, be over-stated. Indeed an Indian dietary is considered incomplete without milk or one or other of its various products.

One can see from all this how very necessary it is to adopt suitable measures to increase, improve and cheapen the milk-supply of the country.*

* The following letter written by Sir Gooroo Dass Banerjee Kt., M.A.,D.L.,PH.D., to the author on reading the above paper may interest the reader :—

"I have read with great pleasure and no small profit your interesting and valuable paper on "The Milk-Supply of Calcutta, its Hygienic, Commercial and Social Aspects".

Considering the importance of milk and milk-products in the Indian dietary and the extent of their adulteration, the necessity of improving their quality and increasing their quantity can hardly be overstated. And it may be hoped that this paper, coming from the pen of a distinguished scientist and a recognised leader of thought in our community, will help the solution of the milk-supply problem, by disseminating sound knowledge and sober views on the subject.

The paper deals, in the first place, with the sources of milk-supply, the composition of pure milk, the extent and nature of its adulteration, and the detection of adulteration by simple tests. It then discusses the question of milk-supply in its hygienic and commercial aspects, and among other measures for securing improved and increased supply, it recommends the establishment of model dairies, the providing of good pasture grounds, the opening of milk-markets under proper control, and the institution of prizes for encouraging good dairy management. And lastly, it reviews the social aspects of the question. It appeals to Government, to Municipal authorities and to the people for co-operation in the matter ; and that appeal, it is hoped, will find a ready response.

The paper deserves careful study by every one interested in the welfare of the community."—*EDITOR.*

Fixing of Standards of Purity of Milk and its Products*

In a paper read before the Social Study Society of Calcutta in 1918 on the Milk-Supply of Calcutta, one of us wrote that the absence of authoritative *standards of purity* for milk, ghee, etc., in this country was causing much inconvenience, and prosecutions for adulteration often failed on this account. In Courts of Law, the contending parties set up analytical figures which are sometimes as widely divergent as the poles, the result being that the Courts often feel inclined to accept the English *standards* which are hardly applicable, having regard to the conditions prevailing in India. The opinions of experts based on European experience recorded in standard English books are open to similar objection. At the present time, each analyst in giving his opinion on the quality of a sample of ghee, for example, depends upon his own figures obtained by methods of analysis which might not always be the same as adopted by other analysts, and such opinion would, therefore, necessarily be arbitrary.

To give an idea of the extent of adulteration which is being practised in respect of this most

* By Sasi Bhusan Ghose, M. B. and Chunilal Bose, I. S. O., M. B., F. C. S.—Indian Journal of Medicine, December, 1921.

important class of food, the personal experience of one of us recorded in a paper read before the Calcutta Medical Club may be quoted here :—

"Of 521 samples of milk analysed in the Calcutta Municipal Laboratory in 1905-06, 85 percent of the samples were found adulterated to the extent of 19 to 80 percent : about 60 percent had 25 to 50 percent of added water; only 15 percent having non-fatty solids above the minimum of 8.5 pecent were returned as good. Then again, out of 700 samples of *ghee* analysed in the same laboratory, 25 percent only gave a Reichert-Wollny value of 30 c.c. and above, which is the limit of purity adopted for sampales of gennine buffalo-*ghee*".

The condition of things to the best of our knowledge does not appear to have improved since. In 1918, we suggested the appointment by Government of a committee of experts to consider and fix the minimum *standard values* of the purity of important food-stuffs, such as milk, *ghee*, mustard oil, etc. We pointed out that unless such *standards* were fixed, there would be every likelihood of much contest taking place in Courts of Law and it would be difficult for the Court to come to a decision which would satisfy the ends of justice.

The following case recently tried at the Calcutta High Court may be cited to illustrate the difficulties attending prosecutions for food-adulteration owing to the absence of statutory *standards of purity* of food-stuffs in India. In

this case, the Corporation of Calcutta prosecuted one *ghee*-vendor for selling adulterated *ghee*. The defence maintained that the vendor had imported the *ghee* from a certain district in Madras and had sold it in the same condition in which it was received and declared to be pure. In the opinion of the Corporation Analyst, the sample was adulterated and the Magistrate convicted the defendant. In the appeal in the High Court heard by Chitty and Smither, J.J., their Lordships disagreed in their judgments. Mr. Justice Chitty orderd a retrial *de novo* and was for remanding the case to the Municipal Magistrate for that purpose, but Mr. Justice Smither set aside the conviction and was against a retrial.

For this disagreement, the case was laid before a third Judge, Mr. Justice Woodroffe, who in remanding the case to the Municipal Magistrate made the following observations which are quoted from his judgment :—

"Mr. Justice Smither in his judgment says :— "The principal defence contention is, that according to the standard works on the subject such deduction (that the *ghee* was adulterated) cannot be made. * * * Owing to the nature of the question raised, the present are cases in which the books of experts are in some respects the best possible evidence."

Mr. Justice Chitty, on the other hand, held :— "In connection with these books, I see that one or more of them were marked as exhibits

in the Magistrate's Court. In my opinion, this procedure was incorrect, if it were intended thereby to make these books and all their contents evidence in the case. * * * It would, I think, be dangerous to base the decision of the Court solely on the evidence of books, whether for conviction or an acquittal."

In reviewing these two judgments, Mr. Justice Woodroffe observed that the principle which should be followed in fixing a *standard* had been overlooked and the consequence of his (Mr. Justice Smither's) judgment would be that the present or any future enactment that might be enforced for controlling adulteration of *ghee* would be a dead letter.

On retrial by the Magistrate, the former conviction was upheld and an appeal again made to the High Court which was heard by Justices Chaudhuri and Newbould. In upholding the conviction, their Lordships made the following observations :—

"It is unfortunate that the statute does not lay down a *standard* raising a presumption that the *ghee* is not genuine. In England, a Committee was appointed to enquire and report as to what regulations might with advantage be made under Sec. 4 of the Sale of Food and Drugs Act, 1899, for determining what deficiency, if any, of the normal constituents of butter or what additions of extraneous matter other than water, should raise a

presumption, until the contrary was proved that the butter was not genuine, but no such steps have been taken by the Government in this country and the question of adulteration has become an extremely difficult one in consequence." * * * "The work (of the Committee) was of an extremely difficult and technical nature and was carried on by a Board of Experts and a *standard* was fixed by them. Unfortunately, nothing of that kind has been underken in India and Courts of Law are called upon to decide questions of adulteration upon such evidence as is available in each individual case and arrive at findings on the basis of experiments which cannot for a moment be compared with the experiments dealt with by the Butter Commission."

"It was urged upon us by the prosecution that we should accept the Corporation *standard* and if we were not able to do so, then we should fix a *standard* ourselves. No doubt we must determine whether or not the Municipal *standard* ought to be acted upon in this case, but we must decline to fix a *standard* ourselves if we can not accept it. If we did so, it would be absolutely of no value. It would not be binding upon any other Bench of this Court. As there is no statutory presumption, every case must depend upon its own evidence. *We are strongly of opinion that a statutory standard should be laid down raising a presumption* and cases of

this kind should not be made to depend upon the evidence forthcoming in each case testing the value of the Corporation *standard*."

We may note here that this case dragged on for two years and each party had to incur heavy expenses besides the trouble, worry and annoyance inseparable from prolonged litigation. The inconvenience caused by the non-existence of a *statutory standard of purity* for food-stuffs could not have been more convincingly and forcibly put than what is recorded in the above judgment. We are not aware of any such Expert Committee having been appointed by Government. The work of such a Committee of Experts will no doubt be laborious and may take some time for its completion. They will have to procure samples of known purity from all parts of the country under varying conditions of climate, season, feeding, breed, local conditions etc., and have them carefully analysed by standard methods and the minimum *standard values of purity* fixed on the results of such analysis. The work will, however, have to be done in the interest of justice and of the supply of pure food-stuffs and the sooner it is taken up by Government, the better for all parties concerned.

In order to help the work of such a Committee, if it is decided by Government to appoint one, we propose to deal in this paper with certain data based on our personal observations as well as those observed by

other workers in different parts of India recorded in various journals and publications.

It may be pointed out that unlike other countries, it is a peculiar feature of the milk-supply in India, specially in large towns, that it is often a mixed commodity consisting of the milk of cows and buffaloes in different proportions. There is a considerable difference in the yield and composition of milk obtained from cows and buffaloes. There are appreciable variations in the individual animals depending chiefly on their breeds, feeding, climatic conditions, surroundings, period of lactation etc. Indian cows of certain breeds yield a large quantity of milk, sometimes amounting to about 8 or 10 seers, whereas the ordinary Bengal cow does not give more than 2 seers of milk per day or even less. According to recent Government statistics, the average daily yield of an Indian cow is not more than two pounds (one seer) as compared with that of a cow in the United Kingdom which gives on an average ten pounds (5 seers) per day. In the case of buffaloes, however, some are known to give about 15 seers of milk per day and their yield seldom falls below five seers.

Then again, some cow's milk contains more than 9 per cent of fat whereas others of undoubted purity contain barely 2 per cent (See table II). If 3 percent of

fat (which is the English *standard of purity* of milk) be taken as the minimum *standard of purity* of cows' milk in this country, it will be seen that any sample containing 6 per cent of fat can safely be adulterated with water to the extent of 100 percent and yet it will pass as pure. In these circumstances, it seems to be very necessary that a minimum *standard of purity* of milk should be laid down by law to protect the consumer from the rapacity of dishonest vendors on the one hand and to prevent injustice being done to an honest dealer on the other hand.

Even when a minimum *standard of purity* of cow's milk is arrived at by taking the average of analysis of a fairly large number of samples of milk obtained under varying conditions, there is another difficulty in the application of this *standard* to milk as sold in Indian markets. For here, in India, specially in towns, where there is a large demand for milk, buffalo-milk is largely mixed with cow's milk, diluted with water and sold as cow's milk. As the percentage composition of the of the two kinds of milk varies widely as will be seen from the table given below, the minimum *standard of purity* of cow's milk can not be applied to buffalo-milk.

TABLE I.

Kind of milk	Water.	Proteins	Fat.	Milk-sugar.	Salts.
Cow . . .	86.4	4.0	4.5	4.4	0.7
Buffalo . . .	81.8	4.52	8.2	4.6	0.88

In view of the above facts, it is necessary in our opinion to fix two *statutory standards*, one for cow's milk and the other for buffalo-milk and the vendor should declare which kind of milk he is selling and his commodity to be judged according to his declaration. We would further suggest that no mixture of cow's and buffalo-milk should be allowed to be sold in the market. This should be done in the interest of the consumers; he should get that kind of milk which he asks for and for which he is paying the proper price.

The fixing of a *standard of purity* of milk by legislation has been based in all countries on the percentage of (1) *fat* and (2) of the *non-fatty solids* which include proteins, milk-sugar and salts. From a dietetic point of view, fat is the most important and valuable constituent of milk. The quality of milk should, therefore, be judged by the amount of fat it contains. It has been shown that the percentage of fat in the milk of individual cows is variable. On the other hand, the non-fatty solids in milk is pretty constant in all milk. Therefore,

along with fat, the non-fatty solid figures give a fairly accurate indication of the purity of a sample of milk. A concrete case may be cited. A sample of buffalo-milk containing 8 per cent fat, if adulterated with an equal quantity of water and sold as pure cow's milk, would on analysis give 4 per cent of fat which will satisfy the *standard of purity* for cow's milk and might be passed as genuine cow's milk. But when the non-fatty solids are determined (which ought to be about 10.5 percent in pure buffalo-milk), they would be reduced to 5.25 per cent which would at once indicate adulteration with water, as the minimum *standard* of non-fatty solids for cow's milk is 8.5 percent.

Without entering into the other details of analysis, we have compiled the figures for *fat* and *non-fatty solids* only from the results obtained directly by us as well as from those recorded by other workers in different parts of India in the following four tables.

TABLE II.
Cow's Milk.

Experimenters.	Place of Examination.	Breed.	Number of Samples analysed	Fat (Per cent.)			Solids not fat (per cent)			Remarks.
				Max.	Min.	Mean.	Max.	Min.	Mean.	
S. B Ghosh M.B.	Calcutta	Bengal (Desi)	40	8.30	3.70	5.53	10.80	8.70	9.34	
Do.	Do.	Do.	7	4.98	1.90	3.30	11.18	8.84	9.63	
F.N. Macnamara M.D.	Poona	Sindhi	8	6.11	3.46	4.74	9.95	8.40	8.77	
J.W. Leather Ph.D. ...	Madras	Saidapet	3	4.68	4.0	4.27	9.73	8.99	9.35	
Do.	Poona	Kathiawar	8	6.20	4.97	5.67	...	...	9.05	
Maggitt & Mann	Do.	Sindhi	12	6.80	5.32	6.10	...	...	9.40	
Do.	Calcutta	...	...	...	...	4.4	...	...	9.87	
Stevenson & Simpson ...	Do.	...	...	...	...	4.88	...	...	8.90	
Cripper ...	Do.	...	...	4.9	3.14	3.34	...	...	9.10	
J. N. Dutt M.B. ...	Bangalore	Mysore	58	8.08	2.60	4.58	...	...	8.53	
M. Srinivas Rao M.D. ...	Do.	Ajmere	9	5.48	2.75	4.16	...	...	8.39	
Do. ...	Do.	Baroda	27	6.67	1.60	4.02	...	...	8.42	
Do. ...	Do.	Halfbred-Mysore	4	9.75	1.83	5.17	...	...	8.06	Fed on grass only.
Do. ...	Do.	Nellore	15	6.07	2.31	4.17	...	...	8.32	
Do. ...	Do.	Saniwal	11	6.98	3.74	4.97	...	...	8.11	
L. L. Joshi M.D. ...	Bombay	...	21	6.30	3.0	5.0	9.70	8.16	8.90	Fed on *Mutari* (horse-dung & stable refuse)
McMahan ...	Lucknow	U.P.	75	5.71	4.78	5.48	8.94	8.68	8.78	
Do. ...	Do.	Do.	99	7.0	2.25	4.83	9.95	7.96	8.85	
M. G. Gajjar M.A., F.C.S.	Gwalior	Gwalior	40	6.70	2.40	4.46	10.66	7.48	8.85	
Do. ...	Do.	Do.	51	6.50	2.05	3.91	9.63	6.76	8.12	

TABLE III.

AVERAGE OF THE MEAN OF THE TABLE II.

Fat	4.07 per cent.
Solids not fat	8.82 per cent.

TABLE IV.

BUFFALO-MILK.

Experimenters.	Place of Examination	Breed	Number of samples analysed	Fat (per cent.)			Solids not fat (per cent)			Remarks
				Max.	Min.	Mean.	Max.	Min.	Mean.	
S. B. Ghosh M. B. ...	Calcutta	Delhi & U.P.	20	12.0	6.43	8.20	11.50	8.77	9.95	
Stevenson & Simpson ...	Do.	...	...	...	...	8.02	...	...	10.86	
Cripper ...	Do.	...	...	...	...	7.50	...	...	9.90	
J. N. Dutt M. B. ..	Do.	...	...	9.50	7.0	8.57	...	...	10.75	
J. W. Leather Ph. D. ...	Poona	Jaffrabadi	4	7.32	4.08	6.02	9.63	9.06	9.33	
Do. ...	Do.	Surati	3	8.66	6.86	7.75	9.76	9.60	9.66	
Do. ...	Do.	Kirkee	10	9.95	6.95	8.09	10.04	9.05	9.69	
Meggitt & Mann ...	Do.	Surati	18	12.60	2.60	8.11	10.60	8.90	10.10	
M. Srinivas Rao M. D. ..	Par galore	Mysore	129	11.71	3.55	6.01	...	...	8.8	
L. L. Joshi M. D. ..	Bombay	...	271	8.21	7.11	7.62	9.86	8.81	9.57	
McMahan ...	Lucknow	U.P.	6	7.85	6.97	7.29	9.45	8.61	9.14	
Do. ...	Do.	Do.	9	...	...	6.52	...	...	9.58	

TABLE V.

AVERAGE OF THE MEAN OF THE TABLE IV.

Fat	7.48 per cent.
Solids not fat	9.77 per cent.

We have tried our best to collect and compile all reliable results of analysis of both cow's and buffalo milk from different breeds of animals in various parts of India as shown in the tables No. II and No. IV respectively. From these figures, it will be seen that although the number of samples analysed is not so large as one would have wished for, it may be considered fairly sufficient to justify us to draw a reasonable estimate of the average composition of cow's and buffalo milk in India, and is helpful to us in fixing a minimum *standard of purity* of milk which would sufficiently protect the public and at the same time, would not operate unjustly on the vendor. It may be noted that in individual instances, the fat is seen to vary within wide limits. The same animal, which at one time yielded milk containing 6.7 per cent of fat gave only 3.7 per cent on another occasion. In another case, the milk of a cow varied in the fat-contents from 7.3 to 2.9 per cent. These cases must, however, be considered exceptional and can not for obvious reasons be taken as basis for fixing *standards of purity*.

Commercially, as we have to deal with mixed milk of several cows, we would be justified in taking the average of a large number of samples which would thus minimise errors due to extreme variation sometimes met with in individual cows owing to causes which can not always be satisfactorily explained. Taking,

therefore, the average of the mean percentages of fat and non-fatty solids of cow's milk examined in various parts of India, we obtain 4.67 as the figure for fat and 8.82 as that for non-fatty solids (vide table III). If, therefore, *4 per cent of fat and 8.5 per cent of solids-not-fat are fixed as minimum standards of purity of cow's milk*, it will, in our opinion, be a fair and reasonable standard. Any sample of cow's milk giving figures lower than these should be presumed to be adulterated unless the contrary is proved by the vendor to the satisfaction of the Court.

It will strike any one on looking at the tables given above that the milk of various breeds of cows from different parts of India correspond closely in their percentage chemical composition, although the yield of milk by the different breeds varies widely. We, therefore, do not feel justified in recommending provincial *standards*. The *standards of purity* of cow's milk we have recommended might safely be adopted for the whole of India.

The above remarks apply to buffalo-milk also but the *standards of purity* must differ from those of cow's milk. The average of the mean of fat and non-fatty solids in the case of buffalo-milk are found to be 7.48 and 9.77 per cent respectively (vide table V). Leaving margins for abnormal cases, we can safely recommend 6.5 *per cent of fat and 9 per cent of solids-not-fat as minimum standards of purity of buffalo-milk* for all India.

A Few Hints on Sanitary Reconstruction*

The two main problems, on the proper solution of which depends the moral and material regeneration of India, are education and sanitation. The two are so related to each other that any advance in the direction of the former will help the progress of the latter, and *vice versa*. In the present article, I shall confine myself to the consideration of the problem of sanitation, with such reference to educational measures as would appear to have a direct bearing on it.

It is hardly necessary for me to plead the cause of improved satitation in India. When one remembers the appalling annual mortality from plague, cholera, malaria, kala-azar, small-pox, and such like diseases which are all more or less preventible and which have practically been stamped out from other civilised countries by the intelligent and willing co-operation of the people with the Government in the matter of the application of sanitary laws and measures, the importance of the subject cannot be overstated.

The mass of the Indian people are hopelessly ignorant of the primary laws of health

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and sanitation except in certain minor matters of personal hygiene. Even many educated Indians sometimes show an amount of ignorance in this matter which is inexcusable. And even when they know the principles, they do not often apply them in practice. This is due to three causes. In the first place, their conviction is probably not as strong as it should be, which accounts for the prevailing indifference. Secondly, the growth of indolent habits and a lack of sustained energy due to climatic conditions are partly responsible for it. And lastly, the opposition met from the mass of womenfolk (whose voice is supreme in the internal management of the home) to any reform which trenches upon time-honoured customs and practices, however baneful their effects might be, is a source of discouragement to the most ardent reformer.

A concrete example will illustrate the point. Most educated men know how the source of drinking water in the moffusil towns and villages in Bengal gets polluted by noxious discharges and by objectionable practices on the part of those who daily use it for various domestic purposes; yet how many of them take the trouble to prevent such contamination; or even to explain to the people the desirability of discontinuing such insanitary habits and practices and the danger attending the use of such water for drinking and other domestic purposes! Dirty utensils, soiled beds and clothings are washed

in the tank; men, women and children bathe in it, the cattle are watered there, and still the whole village draws its supply of drinking water from the same source, without for a moment reflecting on the grave risk to their health incurred by the daily use of this diluted sewage as drink. The effect is the permanent lowering of health at ordinary times; but in times of epidemics, such as seasonal out-breaks of cholera, the disease spreads like wild-fire through the use of the contaminated water, decimates the population and brings untold sufferings and miseries to many a home, which could have been prevented by the timely observance of a few simple laws of health. People have often and often been told that *boiling* is the simplest, most inexpensive and the most effective method of getting rid of disease-germs from water used for drinking purposes, and that *they should never drink unboiled water, specially in times of epidemics.* Yet how many people have been able to introduce this most simple but urgent reform in their homes in the villages? The truth is that the matter of boiling water for drinking purposes is left to the care of the woman-folk who do not believe in its efficacy and, therefore, do not take the trouble to do it. No wonder, therefore, that our people should suffer grievously during out-breaks of water-borne epidenic diseases.

Most people in the villages do not know that the evacuations of cholera patients contain the causative germs of the fatal disease. These are not only thrown anywhere and everywhere round about the infected house but the soiled beddings and clothings of the patient are also washed in the tank or at the mouth of the well from which the whole village draws its supply of drinking water. Flies carry the germs from discharges thrown on the ground to neighbouring houses, sit on exposed food making it a fresh focus of infection which, with the help of the contaminated drinking water, causes the disease to spread rapidly in the village. Those who nurse the patient do not even care to use soap to wash their hands, considering that simple cold water is quite effective for all cleaning purposes. They touch food and drink with their ill-washed and, therefore, infected hands, and this is how a number of people in the house fall victims to the disease one after another. No one has ever heard of cholera attacking the ward-servants or the staff in a well-managed cholera hospital, yet in private houses, even of well-to-do Indians, case after case crops up owing to people failing to carry out, through sheer apathy and ignorance, the simple necessary precautions against the spread of infection.

Thus we find that education comes in as a principal factor for improving the knowledge of sanitation among the people. We must, therefore, look upon it as the first step in the satisfactory solution of the difficult problem of sanitation in India. Not only the ideas but also the habits of the people as well require through over-hauling before we can expect to see *sanitary houses*, *sanitary villages*, and *sanitary towns* in India. Time-honoured customs, long-cherished prejudices, blind conservatism, indolent habits, and the inborn instinct of *fatalism* in the people, all these have for ages exercised a most deadening influence on the national life of India, and have very nearly closed its main spring, making the current of life stagnant and unhealthy.

It is an up-hill work beset with serious difficulties at every step, requiring for its accomplishment a considerable amount of tact, patience, perseverence, self-sacrifice, money and an intimate knowledge of the internal life of the people. But one need not despair at the magnitude and difficulty of the task. The situation has to be met, and the sooner it is met, the better. Already good work is being done at many places ; it will have to be steadily pushed on and re-inforced with fresh supply of men, money and energy, and it is to be hoped that our educated countrymen will rise to the occasion, put their shoulders to the wheel and help the onward progress of the movement.

Experience has shown the danger of the enforcement of sanitary regulations among

the people of India by penal provisions alone. The best intentions of Government have often been misunderstood. A widespread panic accompanied by dislocation of business and rioting has, on more than one occasion, attended the efforts of the authorities to protect the people from suffering and death. I shall never forget the deserted and melancholy appearance which Calcutta, the city of palaces, presented at the time of the first appearance of plague in Bengal in 1897. The authorities had built temporary hospitals in Calcutta for the accommodation of plague-patients which alarmed the people and led them to believe that the plague-regulations of Bombay were soon to be enforced in Calcutta. The result was that for three days, a continuous emigration of the city population took place and endless streams of people, including women who had never been out in the streets of Calcutta carrying a number of children in their arms, were seen laboriously marching long distances to the railway stations at Howrah and Sealdah, accompanied by men carrying heavy luggages, as hackney carriages or coolies could not be had either for love or money. It was impossible for the railway authorities to provide accomodation for such a crowd at such short notice ; so the panic-stricken people had to wait for days on the railway platforms and grounds before they could be dispatched to their destination. They waited there, not

caring for food, drink or sleep, and even a few cases of child-birth were reported to have taken place under these distressing circumstances. Those who could not get trains proceeded by bullock-carts, by country-boats, or even on foot to their native villages. There were a few cases of ambulance-cars burnt in the open streets by an excited mob and the drivers roughly handled. Sir John Woodburn was then Lieutenant-Governer of Bengal ; he was one of the most kind-hearted of men I know of. He saw the gravity of the situation, and the plague-regulations which were in force in Bombay were not adopted by him. They were so modified that they allowed the residents of Calcutta to treat patients in their own homes if they so wished. This at once produced the desired effect, allayed the panic, restored public confidence and the city soon resumed its usual busy and cheerful aspect in spite of the ravages of the epidemic.

This is one of the most serious dangers attending the enforcement of sanitary measures among an illiterate community which must be guarded against, as it might lead to political troubles. It requires a considerable amount of tact, judgment, and sympathy combined with firmness on the part of the Government and of the leaders of the community to succeed in introducing necessary sanitary measures without causing any untoward consequences. In this case also, ignorance is the root-cause

of the mischief and the remedy lies in the diffusion of knowledge among the masses. Often the expenses imposed upon the people by the introduction of sanitary measures, as for instance the enforced segregation at the time of plague, cannot be borne by the people themselves owing to poverty, and hence discontent and resentment follow the forcible application of the measure. Here sympathy, tact, and adequate pecuniary help from the authorities will considerably smooth matters and bring success.

I now propose to consider briefly the ways and means for improving the existing state of things, and I would suggest a few measures which might help towards a partial solution of this difficult problem. As light dispels darkness, so knowledge dispels ignorance. It must always be borne in mind that no amount of legislation for improvement of public health will produce the desired result unless the people are sufficiently advanced to understand the object of the measure and the benefit that will accrue from it. The soil must be prepared first before the seed is sown. The first and foremost measure, therefore, is the *diffusion of knowledge*, as widely as possible, among the people of the country. As our children begin to learn the alphabets of their vernacular, they should be made to learn also what may be called the alphabets of Hygiene. There should be a graduated course in Hygiene for our schools, both

for boys and girls, beginning from the *Pathsalas* and *Maktabs*, and ending with the University Matriculation Examination in which Hygiene should form one of the compulsory subjects. It may be noted here that the University of Calcutta is contemplating the introduction of Hygiene as one of the optional subjects in the Matriculation Examination.* I am, however, of opinion that so long as the study of Hygiene will remain optional in our schools, it will not produce the desired result. But the reform is welcome on the principle that "half a loaf is better than no loaf".

There are, at present Government Training Schools where *gooroos* and teachers have to receive practical training in methods of teaching. A short elementary course in Hygiene should form a compulsory part of the curriculum for those who join the training schools and they must pass an examination in Hygiene at the completion of their training period. A certificate of competence in the teaching of Hygiene should be considered as a necessary qualification for employment as a teacher in our schools.

It may be said that such measures would benefit the school-going children only, who form but a very small fraction of the total population of India. No doubt the present value of

* Hygiene has since been made an optional subject in the Matriculation Examination in the Calcutta University.—*EDITOR.*

the measure suggested is very limited, but it cannot be denied that it possesses a great potential value. These boys and girls would form so many focii for the spread of the knowledge of the laws of health, not only in their own homes but to future generations as well. Besides, the day is not distant when it is hoped that primary education will be made compulsory and the good effect of the measure now suggested will then reach the greater portion of the population of India.

Not only book-lessons but practical instruction in Hygiene by personal example and by object-lessons should be imparted to boys and girls in schools. They should be made to see that the water they drink in the school is always *boiled*. The teachers when lecturing on the evil effects on health produced by the use of dirty clothes should themselves wear clean clothes in order to set an example to their pupils. The school-building may be made of cheap and simple materials, but it should be so constructed as to admit of plenty of air and light and be kept scrupulously clean, dry and free from jungles both inside and outside. The arrangements for the drainage of the school and the situation and construction of the privies and urinals should form object-lessons to the pupils, so that they might follow the same principles in the construction of their own houses when necessary. The aesthetic side should be helped to develop as much as

possible by employing boys to do a little gardening in the school-compound, and the school-funds should allow of a little money being spent annually for this purpose and for the purchase of gardening implements.

To make the knowledge of hygiene reach the masses, popular lectures illustrated by magic lantern slides and cinema films should be organised and bands of voluntary workers from the educated community should be formed to do a little selfless work for the benefit of their less advanced countrymen. The long vacations which our more advanced boys and girls get in the colleges twice a year could be best utilised for this purpose. City and moffusil boys may join hands and raise small units of *social service workers*, organise plans for visiting by turn towns and villages in the moffusil as most convenient for each unit, and periodically do a little educative work among the villagers. Medical students can render very valuable service in this connection. These young men should form a committee with some of the enlightened and public-spirited gentlemen at the head-quarters of each district, the medical men of the place forming an important part of the organisation which should raise funds, purchase the necessary apparatus for the lecture-work, pay for the actual expenses of the itinerant lecturers, and distribute the work among the several units formed for that district. Municipalities and District Boards

should give liberal financial help to these organisations, which should be supplemented by private benevolence. Leaflets on health-subjects should be printed and widely distributed among the literate village population,

It must be admitted that it is most difficult to reach the women-folk. This cannot usually be done by men (except by members of the family) in many parts of the India, the *purdah* system standing in the way. Bombay is more fortunate in this respect, and with the intelligent and willing co-operation of our sisters, the social problems there have made much greater progress towards solution that in any other part of India.

The heavy annual mortality among Indian infants calls for immediate remedial action. Ignorance, unhealthy social customs, poverty, insanitary surroundings and bad midwifery account for this deplorable state of things. The employment, at public cost, of Lady Health Visitors and qualified midwives whose duty would be to attend on poor women free of charge in their own houses in their delicate condition and during labour and confinement, looking after the infants for the first few months of their life and visiting other houses and generally advising women in matters of health and sanitation will considerably improve matters in big cities. Something like this is being done by the Calcutta Municipality and the results so far have been satisfactory.

The example may be followed by the municipalities of other big towns in India, and a large number of infants will thus be annually saved from preventible death. The work may likewise be started on co-operative principles in some of the populous villages. Besides, Indian ladies of more advanced communities who do not observe the *purdah* system, would do well to form *Visiting Committees* to carry on edcative work among their less advanced and poor sisters in the cities. Their sympathy, kindness and advice will be greatly appreciated and produce good results in the matter of the education of the children, improved sanitation of the houses and development of home industries.

Most villages in India are without qualified medical men and good medicines. According to a recent estimate made by a well-informed public-spirited Bengali gentleman, there is in rural Bengal one qualified doctor for every 42,000 of its inhabitants. No wonder that many people die in India without being seen by a medical man or getting a drop of medicine. The question of supplying qualified medical help adequately to Indian villages is a very difficult one. The men turned out by our medical schools and colleges cannot be expected to settle in villages as private practitioners, as the income would be too small to satisfy their ambition. It is also impossible for the Government to provide each village with a medical man

as the cost would be prohibitive. The proposal to subsidise the existing qualified men practising in villages to attend gratis on poor people is well worthy of experiment. What is required is the revival of *vernacular medical schools*, where a class of men, after passing the Upper Primary or the Middle English Examination could get an adequately fair course of training in medicine through the medium of *vernaculars* for the treatment of ordinary and infectious diseases prevailing in the country, extending over a period not more than three years. These men, when they pass out, will have little chance of earning their livelihood in towns and cities, but will migrate to villages and practice medicine there on small fees and thus be accessible to poor villagers. There should be a fair number of such medical schools in every province and they may be started either by Government or by private enterprise. We shall then be able to turn out annually a good number of fairly qualified medical practitioners who would find it to their advantage to settle in villages and bring medical help to the doors of poor villagers. The starting of a larger number of vernacular medical schools is an important factor in the solution of the problem of village sanitation in India. It has been suggested that the present state of things can be greatly improved by working on co-operative lines. Co-operative societies for free medical aid may be started in populous

villages. Each resident of the village should be asked to pay a small contribution towards a fund raised for this purpose. Even if one-twentieth of the population of a village contributes to the fund at the beginning, the work may be taken up with every hope of success. The pay of a medical man of the sub-assistant surgeon class, of a midwife and of a compounder should be met from this fund and the surplus devoted to the purchase of medicines, to the payment of rent of the dispensary-building and to the cost of ordinary sanitary improvements in the village, such as the betterment of drinking water-supply, cutting of jungles, kerosening *nullahs* and *dobas* and filling up holes and ditches to prevent the breeding of mosquitoes, and generally, to improving the drainage and conservancy of the village. In return for their small annual contributions, the villagers would get the doctor's and the midwife's services free of charge, and medicines at their cost price. The doctor and the midwife will be allowed to practise among the non-subscribing villagers on payment of small fees which will supplement their income. Work on these lines has recently been started on a small scale in a few villages in the neighbourhood of Calcutta. It is too early to predict the success of the movement, but the results, so far obtained, are very hopeful.

Work for the prevention of malaria, kala-azar and other infectious diseases may also be started on *co-operative* lines. Work for the prevention of malaria and kala-azar on co-operative basis has just been started in Calcutta by the Central Antimalarial Co-operative Society Ltd. of Bengal. If the funds of societies like those referred to are in a prosperous condition, travelling dispensaries may be organised and peripatetic doctors engaged to extend the work of free medical relief to neighbouring villages which are too backward to join at once the parent society by contributing to its funds. This will be necessary in times of epidemics only, that is, in malarial seasons and during outbreaks of cholera and small-pox. Organisations like the Bombay Social Service League, the Bengal Social Service League, the Bengal Health Association and the Servant of India Society form excellent nuclei for the propagation of educative sanitary work. Bombay is again ahead of Calcutta in this matter, but Calcutta is following her foot-steps and hopes to show a little good work within a reasonable distance of time. Social service leagues should be organised in all the chief towns in India, and special sections should be devoted to medical and sanitary work alone. There will be no dearth of workers among our students many of whom are inspired with a genuine love for their country and are ready to serve her with selfless devotion. The Leagues should make arrangements for giving special training to these bands

of young workers in lecturing and in practical sanitary work. This work should be controlled by medical men who should deliver regular courses of instruction at the headquarters in these subjects for the benefit of the volunteers, prepare books and pamphlets for their guidance and for distribution to the literate among the masses. Along with instructions on sanitary subjects, lessons on *First Aid* and *Nursing* should be included in the course which would considerably expand the sphere of useful work done by these volunteers for the relief of human suffering.

In this article, I have referred only to the duties of the people in this matter. The Government also has its own duties to perform and we know full well that without its help, no large sanitary problem in India is capable of successful solution. Dr. Lankester in his paper on "Health" published in the first Reconstruction Number of the Social Service Quarterly has put forth certain valuable suggestions in this connection which deserve careful study and attention.

Impure Air and Infant Mortality.*

High infant mortality in Calcutta.—The infant mortality is abnormally high in Calcutta. Nearly 6,000 infants died in this city during the last official year, *i.e.*, about 16 per day and His Excellency Lord Ronaldshay has told us, in his opening speech on the 27th March, 1920, that 14 out of these 16 children were needlessly sacrificed to the ignorance of their parents or others who attended on them. Twenty-five years ago, about 50 per cent of the children born in this town used to die within one year of their birth. In 1895, the mortality was 47·6 per cent; in 1900, it was 44·3. It was much higher in the case of Mahommedans during the same period 75 children of Mahommedan parentage out of every 100 born in Calcutta breathed their last before attaining the age of one year.

Matters have no doubt improved during recent years owing to the opening out and the improved sanitation of the town, the spread of education and the improved income and better modes of living among the residents

* A lecture delivered at the Health and Child Welfare Exhibition, held at the Town Hall, Calcutta, in 1920.

30 and 40 per hundred in this city, and this compares very unfavourably with the rate of infant mortality in other civilised countries.

Its causes.—There are many causes which are responsible for this abnormally high death-rate among infants in Calcutta. Unclean and insanitary condition of houses and of the *bustees* in which they are situated, insufficient food and clothing due to poverty of the people, immaturity of the parents due to child-marriage, seclusion of women, ignorance, superstition, bad midwifery, want of proper care of the mother before confinement, inexperience of young mothers to take proper care of themselves and their babies, impure and inadequate milk-supply,—these are some of the causes which lead not only to high infant mortality but are responsible for a large number of deaths among mothers also.

Condition of lying-in rooms in Indian houses.—The extremely insanitary condition of *lying-in* rooms in many Indian houses considerably adds to this increased death-rate among new-born babies. One thousand seven hundred and ninety-one infants died in this city in 1918 before they were one week old, *i.e.*, while they were still confined within the four walls of the dungeon known as *atoor ghar* in Indian houses. The air in these rooms is rendered so impure by the conditions which prevail there that it is absolutely unfit for human habitation. A

small room in the ground-floor of the house which is useless for all other purposes, is selected for the habitation of the mother during one of the most critical periods of her life. There are few openings for air and light in the selected room, and even those that exist are carefully shut for fear lest the mother and the newborn baby catch cold by exposure. The room is consequently damp, dark and ill-ventilated. The mother is considered to be in a state of impurity during her confinement, and hence this room situated in an out-of-the-way corner of the house is selected for her, which would prevent pollution by her touch of water, food and clothes used by other people living in the house. A fire is lighted in the room morning and evening to apply dry heat to the mother and baby on the idea that it would dispel the *phlegmatic humour* with which the bodies of the mother and baby are believed to be saturated just after confinement. Old and rejected clothes and beddings are reserved for the use of the mother for one month during her confinement, and she is placed in charge of a low-caste female attendant whose clothes and habits are abominably dirty. I would place before you the picture of a lying-in room in Calcutta as drawn by a distinguished European medical man who had to visit such places frequently in his professional capacity and who was at one time the Health Officer of this city :—

"A child born at home (Indian) is from the first carefully kept from all respirable air and remains in an impending state of suffocation for days on account of a pan of charcoal burning in a small closely-confined room where the birth has taken place, into which no air that can be kept out is allowed to enter. I had been to many of these apartments and in none have I been able to breathe; the atmosphere is so foul and fœtid. Hindu women go through this working process from 7 to 10 days or even longer*; and with Mahommedans, it is even longer than with the Hindus, and to this longer process of simmering in fœtid atmosphere is due the higher death-rate among the Mahommedan women and children.

The condition of lying-in rooms has no doubt improved during recent years, but the defects noticed above still prevail in many houses, specialy of poor people and of those who are backward in education.

In the present lecture, I propose briefly to deal with (1) the *composition and properties of air* in its normal condition, (2) *how it is made impure* and (3) *the means of its purification.*

(i) Composition and Properties of Air.

Air is a mixture principally of two gases, nitrogen and oxygen (in the proportion of 4 to

* The period of confinement after child-birth in the case of Hindus ranges from 21 to 30 days.—*EDITOR.*

1); it also contains carbonic acid gas, water-vapour and a few other gases. In the air of inhabited places is found suspended matter consisting of minute solid particles, inorganic and organic, which often contain disease-germs, a larger quantity of carbonic acid gas and other foul gases.

No animal can live, no fire or light can burn without air.

Air is a colourless, odourless, invisible gas—conductor of sound, carrier of smell, a very light body extending about 50 miles high above the sea-level. The whole column of air exerts a very heavy pressure on all objects on the surface of the earth. The weight of this column of air is about 15 lbs. per every square inch of surface of all bodies lying on the surface of the earth.

Oxygen—It is the great supporter of life and combustion. Bodies which burn in air (which contains $\frac{1}{5}$ of oxygen) burns with increased brilliancy in pure oxygen gas.

A few experiments showing the combustion of bodies such as candle, charcoal, sulphur, phosphorus &c. in oxygen were shown.

(*e*) **Nitrogen.**—It does not support life nor combustion. It dilutes the oxygen in the air and thus mitigates its powerful active properties.

(ii) How is the air made impure?

The air is made impure chiefly by (a) *combustion*, (b) *respiration* of animals, (c) *fermentation*, (d) *putrefaction* of organic substances and (e) operation of *certain trades and manufactures*.

(*a*) **Combustion.** When wood, coal, charcoal, oil or a candle burns in air, we say it is undergoing combustion. Such combustion is attended with heat and light, and the products are poisonous carbonic acid and other gases.

(*b*) **Respiration.** Slow combustion takes place within the living body in the act of respiration. The lungs are the organs of breathing. Oxygen is introduced with the inspired air into the lungs and thence carried by the blood to all parts of the body where it slowly burns food and tissues, and carbonic acid gas is produced as the result of the slow combustion and this is eliminated by the lungs with the expired air. The expired air contains 100 times more carbonic acid gas than the inspired air and much foul organic matter exhaled by the lungs and is, therefore, very poisonous. The heat produced by this slow combustion within the body maintains our body-temperature and part of it is converted into energy for internal and external work. When respiration ceases as in dead animals, no more heat is produced and the body becomes cold.

We thus see that both in respiration of animals and in combustion of fuels, the air is constantly losing oxygen and the proportion of carbonic acid gas in it is increasing.

(*c*) **Fermentation and** (*d*) **putrefaction** of organic substances produce many noxious gases besides the carbonic acid gas which are very harmful to health.

(*e*) **Trades and manufactures.**—In many trades and manufactures, noxious gases and minute irritating and poisonous solid particles are thrown out which mix with the air and render it unwholesome.

Carbonic acid gas does not support life or combustion. It is invisible, colourless and odourless and is heavier than air. It is poisonous when breathed in, but when taken into the stomach in the form of aerated waters, it does not act as a poison. The normal air contains ·04 per cent of this gas; if the percentage comes to ·1, it is bad for breathing for any length of time. If it is ·5 per cent, the air is unfit for respiration. Twenty per cent would cause insensibility and death. Carbonic acid, if pure, is not so harmful as when it is present in expired air which contains much foul organic matter.

Some experiments were shown demonstrating the properties of carbonic acid gas.

(iii) Means of Purification.

Natural Means.—The natural means of purification of air are rain, sunlight, winds, diffusion of gases due to difference of temperature and photo-synthesis. Carbonic acid gas is inimical to animal life but is indispensable to plants,

the green colouring matter of which decompse this gas under the influence of sunlight retaining carbon for the building up of their tissues and returning oxygen to the air again. The air is thus being continuously purified by the vegetable world during the day time and this process is known as *photo-synthesis.*

Ventilation.—(a) In cold countries where doors and windows cannot be kept open throughout the year, special contrivances (artificial ventilation) are needed to effect ventilation in rooms. It is usually done by a pumping apparatus to suck bad air out of a room or by driving in fresh air by machinery or by the extraction-method, the chimney over the fireplace helping in the extraction.

(b) By aspiration, air is sucked out by wind blowing over a tube or chimney.

(*c*) Winds are splendid means of ventilation. They sweep impure air out of inhabited rooms. This is known as ventilation by perflation which is the best of all methods.

In a warm country like Bengal, no artificial measures for ventilation are needed. There should be a sufficient number of doors and windows facing north and south and opposite to each other whenever practicable; they should be of large sizes and always kept open. There should be a certain amount of open space round the house so as to offer every facility for the free passage in and out of the air.

The popular dread of catching cold by keeping the windows of bed-rooms open is groundless. Most chest-diseases are caused by microbes which exist and thrive in the vitiated air of closed rooms. Much consumption in this country is due to the habit of the people to sleep in closed rooms. The best chance of cure of consumption is to live in open air. Even in the cold weather, some of the windows of the bed-room should be left open during night.

Several interesting experiments were shown to demonstrate that two passages are needed for proper ventilation in a room—an *inlet* for the entrance of fresh air and an *outlet* for the exit of vitiated air. A good many openings should be kept in the wall near the ceiling for the passage out of the respired air which, being warmer, is lighter than the outside air and, therefore, rises above and rests under the ceiling.

Air-space.

Each individual in a bed-room ought to get 1,000 cubic feet of air-space and never less than 600. This can be found out by multiplying the length, breadth and height of the room and dividing it by the number of persons occupying it. All space occupied by furniture should be deducted and allowance made for lamps burning in the room. Each kerosene lamp pollutes the air to the same extent as seven persons living in the room.

Floor-space.

The floor-space is calculated by multiplying the length by the breadth of the room. It should not be less than 8 feet × 8 feet for each adult person or 64 square feet. It should be, if possible, 100 square feet (10 × 10).

There should be a provision of at least 16 square feet floor-space for each pupil in the class-room, provided that the room is well-ventilated and that all the doors and windows are kept open. In rooms where crowded meetings take place, there should be ample provision for easy ventilation.

Confined air and consumption.

It is a matter of common knowledge that consumption is on the increase in this country, specially among young Indian mothers, and Lady Chelmsford in her Delhi speech on the occasion of opening the Women's Medical College there in 1913 very forcibly referred to this matter and made an earnest appeal to the women of this country to see to the necessity of living as much as possible in fresh air which is the best preventive of consumption.

Her Excellency said :—

"In some of the hospitals I have visited, I have been shocked to see cases of quite young women suffering from consumption and distressed to learn what a common disease consumption is in this country. I believe this is a matter in which the women of India, especially the educated women, could do a great deal. The great preventive and cure of consumption is fresh air ; and if the women would accustom

their children to sleep with doors or windows open or on the roofs of their houses from their earliest childhood, they would arm them with greater powers of resisting cold and fortify them against the dread of the disease and they would be thus doing a great deal in the direction of stamping it out. That there are laws of health which cannot with impunity be disregarded is now common knowledge, and I would make an earnest appeal to the women of this country to see to it that they be followed."

Sick-rooms in Indian houses.

If efficient ventilation is so much needed in our dwelling-houses in ordinary times, how much more urgently is it needed when sickness prevails in the house? One cannot too strongly condemn the unhygienic conditions which ordinarily prevail in sick-rooms, even in the houses of the better-class Indians who ought to know better. The late Sir Pardey Lukis who had an extensive consultation practice in Calcutta among the well-to-do classes, thus records his experience of the state of the sick-room in Indian houses in his book on Tropical Hygiene ;—

"During sickness in a house, good ventilation is more important than ever. Indian people generally close all doors and windows tightly in the sick-room. This is the worst thing that can be done, as the patient is not

only being poisoned by his own breath but by the breath of those waiting on him, and there is no condition in which a man requires good fresh air so much as when he is ill. In time of sickness, do not allow many relatives and friends to come and see and attend the sick man. We have often seen patients in a small room—perhaps not containing 500 cubic feet of air altogether—and in this small space, there have been crowded together for several hours 10 or 12 relatives and friends of the patient. Nothing could be more harmful to the patient who is being slowly poisoned by the organic matter and gases given off by his friends' clothes and bodies. Never allow more than one or at most two people to be with the sick person. When a person falls ill and is likely to be ill for even a day or two, he ought to be placed in the largest room in the house. He needs all the air he can have to help him to get well again."

"When we think of how most Indians shut up all the doors, windows and ventilation-holes in their rooms, how several people go to sleep in the same small room and how they cover up their faces with a sheet of blanket, we cannot wonder at the feeble health so many suffer from."

Foul air and infant mortality.

All these necessary hygienic measures are utterly neglected in the case of *lying-in*

rooms in many Indian houses. I have already said that the room selected for this purpose is usually very small and damp and all air and light are shut out of it. The air-space is absolutely inadequate for three people viz., (mother, the baby and one female attendant) confined there for about a month continually for day and night, and the atmosphere is rendered foul by the breath of the occupants of the room as well as by foul gases emanating from the pan of burning charcoal kept there morning and evening. In these circumstances, is it any wonder that so many babies die within a month after their birth? One should rather wonder that any baby would be so lucky as to survive such unhealthy conditions of living.

Appeal.

A considerable saving of baby-life will be effected by (1) improving the sanitary conditions of our *lying-in rooms* and (2) by employing *skilled help* during labour, and I would earnestly appeal to my countrymen to devote their earliest and best attention to this matter.

Maternity and Child Welfare Work in India. *

The importance of Maternity and Child Welfare Work in India cannot be too strongly emphasised. There are, no doubt, many difficulties in the way of popularising it in this country. The wide prevalence of ignorance and religious superstitions, the crushing poverty through which the teeming millions of India struggle from year's end to year's end and the blind faith of the people in long-established customs and habits, are some of the principal factors which operate prejudicially on the successful working of any scheme for Maternity and Child Welfare Work in India.

But, although the difficulties are great, they are not insuperable and much may be done to improve the present deplorable state of things and to prevent the untimely death and loss of health of thousands of our young mothers and babies by the adoption of measures based on sympathetic, intelligent and organised co-operation between the Government and the people of the country.

* Maternity and Child Welfare in India (Journal), the organ of the Lady Chelmsford All India League for Maternity and Child Welfare, December, 1921 and March and June, 1922.

It is satisfactory to note that the seed of Maternity and Child Welfare Work, based on modern scientific methods, has been implanted in Indian soil and that the work has been taken up in right earnest in some of our principal towns. There can be no doubt that the work is slowly but steadily developing. Thanks to the deep sympathy of Lady Chelmsford and the active interest taken by her in this important work during her sojourn in India and afterwards, it has received a great impetus and the Maternity and Child Welfare Exhibitions organised under her beneficent care and august patronage, held at Delhi, Bombay, Calcutta and in other important centres, have materially contributed to concentrate public attention on this subject and to arouse an amount of intelligent pubic interest which is sure to prove most helpful to its continued progress and development.

In this short paper, I have endeavoured to indicate some of the principal causes which stand in the way of development of this work among the Indian population, especially the poorer middle class and the masses, and to offer a few suggestions which are likely to prove useful in removing the difficulties and helping the spread and expansion of the movement, with a special reference to the results of their application in Calcutta.

Ignorance and poverty are the two root causes of all evils, and they are responsible

for the very heavy but preventible loss of life among infants and young mothers in India. The rate of infant mortality in India is appallingly high as compared with the incidence of death in child-life in the other civilized countries of the world. All this waste of budding humanity is preventible, and countries in the West have done much by the adoption of suitable measures to considerably reduce this wanton loss of child-life which once formed a notorious feature of the health reports of many of the congested cities of Europe.

Much of the mortality in young mothers and babies in India is due to immature motherhood and to ignorance in the management of cases of labour. Owing to the prevalence of the custom of early marriage, many Indian girls become mothers before they are fully grown up and before they are sufficiently strong to bear the strain of motherhood. Frequent child-bearing undermines their constitution and brings on premature old age. Immature parents beget immature children with weakened natural resistance, who easily fall victims to disorders which robust babies, born of mature parents, could successfully resist. To frequent child-bearing must be added want of proper nourishment on account of poverty and unfavourable hygienic conditions under which the poor Indian mother is obliged to live in ill-lighted, ill-ventilated and congested apartments of in-

sanitary dwellings in large cities like Calcutta or Bombay. These conditions work together to break their constitution early, and it is no wonder that they frequently contract mortal wasting diseases. Among these is Consumption (Tuberculosis) which is found to be alarmingly on the increase in the last few years. Being a disease of darkness and foul air, it is more prevalent amongst towns-people than among those who live in the country where they freely enjoy sunlight and fresh air. This disease is more prevalent among young women, espacially during their child-bearing period, than among men, as will be seen by a reference to the Annual Report of the Health Officer of Calcutta for 1920-21. The figures for the last three years show a steady increase in the mortality of the city from this cause :—

Year	Number of deaths from Tuberculosis.
1918	1,826
1919 , ...	1,889
1920 , ...	2,120

Dr. Crake's observations on this subject, quoted in the "Statesman," are as follows :—

"The death-rate from tuberculosis amongst females was 3·6 per thousand or more than double that amongst males (1·7 per thousand). Further, this excessive mortality occurs chiefly amongst young women."

Age-group—years	Death Rate.	
	Males.	Females.
	Per thousand.	Per thousand.
10—15	·32	2·1
15—20	1·3	6·5
20—30	1·7	5·9
30—40	2·4	5·5

These figures are positively startling, as for every boy that dies of tubercle, six girls die, and for every young man that dies of tubercle, five young women die.

Says the Health Officer :—

"I am convinced that the chief cause of this appallingly high rate of mortality amongst females is the retention of the *purdah* system in the slums of a great city. It is difficult to secure absolute privacy in narrow streets and gullies without sacrificing light and air. In fact, the *purdah* system is responsible for many of the extremely insanitary buildings one finds. Even when a portion of the house is fairly lighted and airy, the women's appartments are rarely located there. The *zenana* is almost invariably in the inner portion of the house, ill-lighted and ill-ventilated but effectually screened from observation."

Ignorant and dirty midwifery is responsible for a large number of deaths among newly-born infants and their mothers by producing septic

infection. In the large towns of India, the advent of scientifically trained midwives has to some extent improved the old deplorable state of affairs. But here also the interference of the ignorant and superstitious female members of the house (whose voice is paramount in such matters) often nullifies the good effects of the hygienic measures adopted by qualified midwives. Refusal to avail themselves of skilled medical assistance from male experts in cases of difficult labour and the extreme reluctance to go to hospital account for many cases of preventible death of both mothers and babies. Among other notorious features in the life of a recently confined mother in most orthodox Hindu and Mahommedan houses may be mentioned the bad selection of the *lying-in* room, the use of old and dirty clothes and bedding, the rigid exclusion of fresh air and light from the room where she and the new-born baby are kept confined for nearly a month, the burning therein of a charcoal fire morning and evening to drive away cold and the association of a low class dirty female as a personal attendant. I have heard young mothers describe their experience in confinement rooms as "worse than being in hell." If this is the state of affairs in the houses of well-to-do people, the condition in those of the poorer middle classes and of the masses can better be imagined than described. A great improvement has no doubt been effected in the houses

of educated Indians in the matter of lying-in rooms and management of cases of labour, but much remains yet to be done and it is hoped that as the light of knowledge illumines the Indian zenana, much wanton waste of life and much suffering will be prevented.

Death from infantile tetanus was at one time very common among Indian babies who were brought into the world by the assistance of indigenous ignorant dhais. It generally occurred within a week of their birth and was due to sepsis introduced by the dirty low class midwife in the act of cutting and dressing the cord. Tetanus in babies born in public hospitals in India is a rare phenomenon. Even as early as 1885, the Health Officer of Calcutta, reporting on infantile mortality in this city, observed that no death from tetanus occurred in babies born in the Eden Hospital during that year, and so late as 1918, according to the same officer, not a single case of Tetanus Neonatorum occurred among 1,621 births attended by the Corporation midwives, a clear proof that this is due to dirty midwifery and is an entirely preventible disease.

The old indigenous dhais are rapidly being displaced by qualified midwives in the chief towns of India, but in muffusil towns and villages, theirs is the only help available in many places, and the poverty of the people and their tenacity to established customs will

perpetuate this undesirable state of things for a long time to come. Attempts are being made to hold classes for these dhais of the old type to give them practical instruction in the management of labour cases on modern lines, and we hope they will show better work as the result of such training.

EXCEPT in certain matters of personal hygiene, the great mass of the population of India is very backward in knowledge of the laws of health and sanitation, based on the modern discoveries of medical science.

I may quote here what I wrote in 1919 in the *Social Service Quarterly* of Bombay :—

"Even many educated Indians sometimes show an amount of ignorance in this matter which is inexcusable. And even when they know the principles, they do not often apply them in practice. This is due to three causes. In the first place, their conviction is probably not as strong as it should be, which accounts for the prevailing indifference. Secondly, the growth of indolent habits and a lack of sustained energy due to climatic conditions are partly responsible. And lastly, the opposition met from the mass of womenfolk (whose voice is supreme in the internal management of the house) to any reform which trenches upon time-honoured customs and practices, however baneful their effects may be, is a source of discouragement to the most ardent reformer."

What is necessary is the educating of public opinion in matters of modern hygiene and sanitation. Education comes, therefore, as a principal factor in the consideration of remedial measures. It must be a slow and up-hill work requiring much patience, tact and perseverence on the part of both the Government and the leaders of the people, but one must not despair at the magnitude and difficulty of the task. The situation has to be met, and the sooner that is done, the better will it be for all concerned. The surest way of successfully grappling with the problem is through education. As light dispels darkness, so knowledge clears away superstitions and blind faith which proceed from ignorance. The first and foremost measure, therefore, is the diffusion of knowledge of the laws of health as widely as possible among the people. As our children begin to learn the alphabets of their vernacular, they should be made to learn also the alphabets of Hygiene. There should be a graduated course in Hygiene in our schools from the primary stage up to the Matriculation standard, both for boys and girls. It may be said that such a measure would benefit the school-going children only, who form but a small fraction of the total population of India. No doubt the present value of the measure suggested is very limited, but it cannot be denied that it possesses a great potential value. These boys and girls would

form so many foci for the spread of knowledge of the laws of health, not only in their own houses and neighbourhood, but to future generations as well.

Besides book-lessons, practical instruction in Hygiene by personal example and by object-lessons should be imparted to boys and girls in schools.

To make the knowledge of Hygiene reach the masses, popular lectures illustrated by magic lantern slides and cinema films, and Maternity and Child-Welfare Exhibitions should be organised and bands of voluntary workers from the educated community should be formed to do a little unselfish social service work for the benefit of the less advanced members of the community. Already such work has been undertaken by some of the Social Service Societies in different parts of India, and the Government Health Departments are also encouraging the movement by the help of men, money and appliances. Municipalities and District Boards should give liberal financial help to these movements which should be supplemented by private benevolence. Leaflets on health subjects and domestic hygiene should be printed and widely distributed among the literate village population.

It must be admitted that it is most difficult to reach the women-folk in India, the *purdah*

system standing in the way. Lectures by Lady Doctors to *purdah* women on subjects of Health and Sanitation have been started in Calcutta and the result so far has proved satisfactory. Houses of respectable gentlemen in different localities of the town are selected for such lectures ; there is always a fair attendance and the *purdah* ladies have begun to take an intelligent interest in the work. There is, however, a paucity of lady lecturers and the work has not yet been properly organised. Health-lectures to ladies only by medical men have also been taken in hand by some of the schools and colleges for girls in Calcutta. The attendance is not confined to members of the institutions only but to outside ladies also, and I saw them attending in large numbers in the Brahmo Balika Vidyalaya where I recently delivered two lectures on Hygiene. These are happy signs of the time and augur well for the future of Maternity and Child Welfare Work in this city.

In addition to the above in large towns, regular instruction in personal and domestic hygiene should be given by the Lady Health Visitors to *purdah* women when visiting their houses, and they should spare no pains to see that their instructions are properly carried out. Rewards in the shape of clothings for mothers and children, toys, sweets and biscuits, useful household furniture, and, in some cases, small purses should be given to those who willingly

and loyally carry out the advice. such gifts will act not only as an encouragement but will be of real help to needy families.

Among the Christian community, there are committees of ladies whose duty it is to visit the poor and the sick and to help them with advice, money, medicines, food and other necessaries of life. It is high time that such committees should be formed by Indian ladies of light and leading in the chief towns of India. I believe Bombay has got such a committee, and I am glad to note that a women's committee of social workers has just been started in in Calcutta. * The members of these societies would do well to carry on education work among their less advanced and poorer sisters in the cities. Their sympathy, their kindess, their advice and their generous gifts will not only be greatly appreciated but will produce good results in the matter of the education of children, sanitation of the houses, improvement of moral surroundings and development of home-industries.

Poverty is one of the most potent causes to which the high infant mortality in the large cities of India is mainly attributable. So far as Calcutta is concerned, the observations of the Health Officer of the city are quoted below, and these observations may be said to

* It has since been named as the Bengal Presidency Council of Women consisting of both European and Indian ladies.—*EDITOR.*

apply equally well to other large cities in India where the conditions of life are practically the same. The Health Officer in his annual report for 1915-16 said :—

"More than one-third of the total deaths among infants occurred during the first week of life. The great majority of the deaths (1,210 out of 1,603) was due to premature birth and debility at birth. The causes of this literal decimation of infants born in Calcutta must obviously be almost wholly maternal. *Poverty* and consequent lack of good nourishing food is probably one of the chief factors. When the expectant mother is not only underfed but is also subjected to the strain of pregnancy and lactation at short intervals and constantly exposed to insanitary surroundings as a *purdahnashin*, puny sickly babies who only survive a few days, are the inevitable result."

Poverty is not only responsible for an inadequate supply of nourishing food to the mothers but it directly stands in the way of their getting adequate medical and trained help during confinement, and it exposes them to risk of imbibing septic and other diseases, inseparable from dirty midwifery and insanitary surroundings.

This leads us to consider the measures which have proved useful in reducing infant-mortality in other countries and which are likely to prove useful in India, provided they are so modified as to suit the special conditions of the social life of the people. The chief object of these measures is to improve the health of the poor expectant mother by bettering her sanitary surroundings, giving her expert advice in matters of domestic hygiene and her preparation for the confinement period, placing

skilled medical help at her disposal during and after child-birth and providing for better nourishment, both for her (before and after confinement) and for her baby during the first few months of life.

The measures which have proved successful in other countries are the establishment of (1) *Antenatal Clinics*, (2) *Maternity Homes* and (3) *Baby Clinics*. Expectant mothers are induced to visit the *Antenatal Clinics* (which are in charge of qualified medical men or women) and not only treated for ailments due to pregnancy, but are advised how best to conduct themselves during the child-bearing period and the poor among them are helped, with the co-operation of philanthropic societies, with milk and other nourishing food at nominal cost or without any charge at all. They have proved of immense value in countries which are advanced in education and in the ideal of liberty of women. The *purdah* and the ignorance of the people of India will yet for a long time stand in the way of general success attending the establishment of *Antenatal Clinics* in this country; but a few may be started in big towns for the benefit of the poor of the communities who do not observe *purdah*. If these Clinics are in charge of Lady Doctors, the prejudice, I apprehend, will gradually wear out, as the community advances in education.

As there is such small hope of success for *Antenatal Clinics* in India at the present moment, I would suggest a modification of the system which I recommended in a paper of mine on the Milk-Supply of Calcutta published in 1918 * and which, I believe, would go a great way to solve this difficult problem. I would have the poor expectant mothers in the larger cities of India regularly visited in their own homes by Lady Health Visitors in the employment of Municipalities, helping them to improve the sanitary condition of the house, advising them how best to make themselves fit for the coming critical period and to obtain medical advice for ailments such as albuminuria, œdema etc., incidental to pregnancy, supply them with medicines and nourishing food free of charge where necessary, providing for sanitary appliances and skilful medical help during child-birth and for a short period after it and looking after the baby for a few weeks after its birth.

There are already good nuclei for such work in Calcutta, Bombay and a few other principal towns in India. In Calcutta, the Corporation employs a certain number of Lady Health Visitors and qualified midwives to do work of this kind. What is required is the expansion of the system, so that every poor woman in the city might get its fullest advantage for the preservation and betterment of infant-life in the city.

The question of supplying good nourishing food to the poor mothers is more complicated

* See pages 154 to 158, Vol. II.—*EDITOR*.

in India than in Europe, owing to religious and caste prejudices. The only foods to which objection will not be taken are milk, barley, sago, sugar, fruits etc.

Milk depots should be opend by Municipalities, assisted by public philanthropy and State-aid, for supply of milk free of cost to mothers and babies on presentation of certificates issued by Doctors at the Centre. In regard to the care to be taken by the State for the protection and supervision of child-life in a community, the remarks of Sir Robert Armstrong-Jones, made at a meeting of the Royal Society of Arts are worth quoting in this place. Sir Robert observed :—

"Next in importance to the marvellous changes consequent upon the war, has been the fuller realisation of the pressing importance and the sacredness of child-life, and the lesson taught is the precious care that should be exercised in its protection and its supervision. Mothers should receive, by State control, proper, prompt and skilled attendance during and after confinement; infants should receive treatment until the child goes on to the school register, and the home should be visited by authorised persons so as to foster a public opinion educated to set a high value upon infant-life and not to tolerate its neglect. The rebuilding of our manhood is only possible when the dignity of motherhood has become the corner-stone of our public faith and creed,"

There is no doubt that skilled attendance at birth would save hundreds of mothers and babies from premature and preventible death and the establishment of *Maternity Homes* is rightly considered to be one of the means for securing this end. The proposal to start one in Calcutta by the Corporation was first made by our worthy townsman and Municipal Commissioner Rai Bahadur Dr. Hari Dhan Dutt, M.L.C., and I am glad to see the statement by Dr. Crake, the Health Officer of Calcutta, in his last annual report that arrangements for starting two Maternity Homes in Calcutta are being made.* In these homes, the conditions of life of the inmates will be nearly the same as in their own homes, with this exception that there will be better sanitary surroundings, proper medical supervision and treatment with a plentiful supply of good nourishing food and other comforts *free of charge*. A few of these Homes are reported to be satisfactorily working in Bombay. In Bengal where the *purdah* system is very strict, it is doubtful whether at first these Homes will be greatly appreciated and utilised by the people as in Bombay where there is no *purdah*. For *purdah*-ridden people, house to house visitation by trained midwives to attend labour cases *free of charge* is, in our opinion, the best solution of the problem, until such time as public opinion is sufficiently

* One Maternity Home has since been opened at Nilmony Mitter's Street in the northern part of Calcutta.—*EDITOR.*

educated for *purdah* women to take kindly to Maternity Homes. The system of free service by Lady Health Visitors and midwives, introduced by the Corporation in Calcutta, has proved very satisfactory. It is pleasing to note that not one case of infantile tetanus has occurred amongst the babies delivered by these midwives and death among mothers, from septic and other causes after child-birth, has been reduced and death among infants within ten days of birth has also perceptibly declined since the introduction of this system by the Corporation. The number of Lady Health Visitors and midwives employed by the Corporation, although recently increased four-fold, is still quite inadequate to meet the requirements of the city, and in view of the excellent work being done by them, the Commissioners would do well to increase their number at once, so that every poor expectant mother in the city might receive their help in time.

The Maternity Homes will be useful in such hard cases not at all rare in the life of large cities, as described by one of the Health Visitors of Calcutta and noted in the Health Officer's annual report :—

"Some land-ladies have a great objection to a delivery taking place in their premises, and in some instances have turned expectant mothers out during the end of pregnancy."

Dr. Crake, the Health Officer of Calcutta, is doing his best to expand Maternity and Child Welfare work commensurate with the funds placed at his disposal each year by the Commissioners. He began work, a few years ago, with one Lady Health Visitor and four midwives and now he has four Health Visitors stationed at four different centres in Calcutta with 16 midwives working under them. In the opinion of the General Committee of the Corporation, this work is of primary importance in a city where the infantile mortality is great. The maternal mortality was 4·3 per thousand only which may be considered extremely satisfactory and the infantile mortality among cases delivered by the Corporation midwives was 41·6 per thousand, as compared with the general mortality of 117·0 per thousand during the first week of life. Dr. Crake rightly observes that this is a remarkable record, especially in view of the fact that most of the cases were delivered on the 'kutcha' floors of the bustee huts under the most appalling conditions. In most of these cases, the Corporation midwives were called in, after the ignorant indigenous dhais had done their work and the cases had become septic.

Another move in the right direction (and one that will go a great way in popularising Maternity work in Calcutta) has been taken in hand by the Corporation by sanctioning and providing for the expert help of an Obstetrician,

free of charge, in those cases of difficult labour that are attended by Corporation midwives and which, in their judgment, are considered to require the aid of experts.

I would conclude my paper, by quoting a few lines from the annual report of the Health Officer of Calcutta for 1920. Dr. Crake says :—

"I have explained in my previous reports that with the present staff, we must confine our energies to babies delivered by our midwives and limit the period of observation to three months. All babies delivered by our midwives are visited daily during the puerperal period for ten days; as soon as that period is over, the babies are entered on the Health Visitor's register and are visited as often as possible till they are three months old. Sickly and weakly babies are visited once a week, but those that thrive, about once a month."

"Simple medicines required for the mother and child, such as Castor oil, Quinine etc., are supplied by the Corporation. A few stock mixtures have also been provided. Provision has been made for the distribution of warm clothing in necessitous cases. The distribution of dried milk has also been started on a small scale. Glaxo, which is the preparation used, has given excellent results so far. During the year under review, the total number of visits paid to babies, from ten days to three months old, was 6,389.

The results of the present system of keeping babies under observation for three months are very encouraging and it is high time for the development of Child Welfare Work. I have submitted a scheme, and the entire organisation will be placed under the control of a fully qualified and experienced superintendent."

The Health Officer of Calcutta is to be heartily congratulated on the successful launching of these schemes. It is to be hoped that his example will be emulated by Health Officers in other large cities of India, thus ensuring the checking of the terrible but preventible annual waste of child-life in this country.*

* The work of Child Welfare in India has received a great impetus by the inauguration of the Annual Baby Shows under the august patronage and noble guidance of Her Excellency Lady Reading.

The St. John Ambulance Association, Bengal Branch, has recently started the Ambulance Sisters' Baby Clinic at 121, Bow Bazar Street, Calcutta, for the benefit of the poor Anglo-Indian domiciled community, which is doing good work not only for the babies but for the mothers as well; the average weekly attendance at the Clinic was 45 mothers and 60 babies in 1924.—*EDITOR.*

Health of our College Students*

A work of great national importance has been undertaken by the University of Calcutta. You are aware of the Student Welfare Scheme which has recently been organised by our University. It has a branch called the *Health Examination Section*, the object of which is to make a systematic examination and record of the health of our college students so as to form an adequate idea not only of their physical efficiency but also of the amount and nature of illness which exists among them. Many of the ailments from which our students suffer are not of a serious character and can easily be cured if proper attention is paid to them at the beginning, but neglected, they may produce permanent organic and constitutional defects. The result of the enquiry shows that these ailments often go untreated, and even serious defects of vital organs remain unattended. Under the scheme, if any defect is found on examination, the doctor advises the student to consult his medical adviser and if necessary, a specialist also, for early and proper treatment of his malady. The importance of the scheme cannot, therefore, be too strongly emphasised. As students of to-day form the future manhood of the nation, the scheme is expected to exert

* An address delivered at the Y. M. C. A. on 12th September, 1922, and published in the Calcutta Review, October 1922.

a most beneficent influence on the development of the future Bengalee race.

Such schemes on an elaborate scale have been adopted in other civilised countries and have produced the best of results not only by improving the health and physique of the student community but also by creating a manly and vigorous national life. I believe Boston is the first city which organised medical inspection of scholars in 1894. There are now more than eighty cities in the United States of America which have made provision for medical examination of pupils in the schools located therein. The British Parliament passed an Act in 1907 providing for medical inspection of school children. We have not got any law on the subject in India and the existing arrangements, I regret to say, are neither complete nor satisfactory. There should be a medical examination of scholars in each school at least once in a year and information on the following points, *viz.*, (*a*) height, (*b*) weight, (*c*) girth of chest, (*d*) lung capacity, (*e*) strengh of the forearms, (*f*) eye-sight and (*g*) presence of disease, etc., should be carefully recorded.

We are not a day too early in inaugurating this reform in our University. Although we have begun at the wrong end (for medical examination of the boys should commence in the schools where some of the physical defects of later life originate and become perpetuated unless timely corrected), I feel sure that much

may still be done by timely advice and prompt action to improve the poor health and remove the defects of our college boys as disclosed by the investigation. The work has just commenced, and owing to financial reasons, we have not been able to expand it as much as its importance and usefulness would demand. The operation of the scheme is now confined to a few colleges in Calcutta, but as our finances improve, we hope to see it extended to all colleges in Calcutta and in the muffusil as well. The Committee have finished their examination of the students of the Presidency College, the Scottish Churches College, the City College and the University Classes and have submitted a report which is a most interesting and useful document. Every one of you should read the report which throws considerable light on the physical defects from which you suffer, and shows how by paying early attention and taking proper care, you can altogether get rid of them or check their further progress.

According to the report recently published by the Publicity Officer, it is satisfactory to note that the work of *medical inspection* of schools has just been taken in hand by the leading muffusil Municipalities of Bengal. Says the Publicity Officer :—

"The Chairmen of the Darjeeling Dacca, Cossipore-Chitpore, Maniktala, South Suburban and Howrah Municipalities are to be particularly congratulated on being the first to inaugurate the long-needed reform. Burdwan and Rajshahi are likely to follow suit. The actual work of inspection is being done by the Municipal Health Officers. The records so far available show that defective eye-sight is very common among the school children. Dental caries and skin trouble are also of frequent occurrence. Enlarged glands, tonsils, heart disease, malnutrition, ear trouble, external eye diseases, etc., are amongst the other defects noted. It is noteworthy that both in Dacca and Darjeeling, only one case of splenic enlargement was found among the school boys. It will be interesting to compare these results with the records of school children in the towns of the Burdwan and Presidency Divisions where malaria is much more prevalent."

You will be surprised to hear that out of every three college students, two, *i.e.*, 66 per cent, suffer from one or other ailment. This is a very disquieting piece of news and I know you will not thank me for giving it to you. But all the same, the evil exists and it threatens to incapacitate our students' lives. We must, therefore, put up a strong fight and try to put it down as best as we can.

Altogether 3,445 students were examined in the four colleges. It is not my purpose to deal with the report in detail but to place before you a few of the more important defects noticed in it and to advise you as to the ways and means, both preventive and curative, which will help you to keep clear of them or prevent further mischief which is sure to follow inaction in such matters.

I. Defects and their Remedies.

(1) General Appearance and Development.—Only in 10 percent of students, good muscular development was noticed. Fifty percent were of medium development, their muscles not being as strong as they ought to be, while 32 per

cent of the students were thin with ill-developed and flabby muscles.

As was to be expected, boys from well-to-do families generally showed better physique and stronger muscles than those coming from poorer homes. This defect in development and musculature may be traced to two main causes, *viz.*, (a) *poor food* and (b) *want of physical exercise.*

(a) *Poor Food.*—The diet of our Bengalee students is physiologically unsound. In it, the proteins, carbohydrates and fat are not in proper proportions ; it is, therefore, an ill-balanced diet. It is too rich in starch and sugar and often too poor in protein material. Starches and fats have nothing whatever to do with the building-up and development of muscles ; it is the *protein only* which helps the repair and growth of muscular tissue. Want of musculature noticeable in the majority of our Bengalee students is chiefly due to deficiency of the muscle-forming element in their daily diet.

The chief sources of protein are meat, fish, eggs, milk and its products and *dal* (pulses). The prices of the first four of these articles have gone up so high during recent years as to be hardly available in required quantity to our poor students. They have, therefore, principally to depend upon *dal* which is the cheapest of all protein foods. But unfortunately they do not or cannot take it in sufficient quantity, firstly, owing to an ill-founded prejudice against it as being an indigestible article of food, and secondly, because it is generally taken in one form only and that also badly cooked and, therefore, uninviting. Many of you are aware that various delicate and palatable dishes may be prepared from *dal*. When it is well-cooked, it becomes easily digestible and 92 percent of its protein-contents could be assimilated in the system, the figure for meat being 97. In the messes and hostels as well as in our homes, those in charge of the kitchen would do well to depart somewhat from the routine method and exercise a little originality and ingenuity in the matter of preparation of our food which is far too often monotonous and unattractive. If they would only make a few palatable dishes in which *dal* forms the principal constituent, not only would the monotony of diet be relieved but in such inviting forms, *dal* would be taken in much larger quantity than now so as fully to meet the nitrogenous requirements of the body.

Wheat-flour is much richer in protein than rice (nearly double). If it forms at least one meal for our young men, it would, to a certain extent, make up the protein-deficiency in their diet. In the hostels and messes, arrangements should be made to supply the boarders with *chapatees* in their evening meals. Prisoners in jails in Bengal are now getting *chapatees* instead of rice in the evening and the Jail Administration Reports show that this

has greatly improved their health. The result of observation in a Government College Boarding showed that deficiency of protein in diet materially affected the health of students and retarded their growth and development. In this case, two sets of students of nearly the same age, one being Anglo-Indian and the other Bengalee, lived under exactly similar conditions of climate, housing, study, play and manual work with this difference only, *viz.*, that the daily diet of the Anglo-Indians contained one-third (33%) more protein than that of the Bengalees. The records of health examination of three years showed that while the majority of the Anglo-Indian students gained in weight, height and girth of chest, the Bengalee students showed a slight increase only in the case of a few, while a considerable number showed an actual deterioration.

I think it is a matter of common knowledge that people of some of the other provinces of India who live principally on *dal* and *rotee* are of much better physique and strength and possess greater capacity for work than the rice-eating people of Bengal and Orissa. The result of the University enquiry also showed that poorly-fed students were generally inferior in height and weight and in grip-force to others coming from well-to-do families.

(b) *Want of Physical Exercise.*—Next in importance is physical exercise which would give you strong muscles, strong lungs and strong heart. Our students should join outdoor games in larger numbers and with greater regularity than they do at present. There has, no doubt, been a great improvement in this matter during recent years, but still a great deal of reluctance is noticeable among the Bengalee boys to do any kind of physical exercise. In schools or colleges, only a limited number of boys is found to take part in games ; the majority avoid it. Physical training must be made a compulsory subject in all schools and colleges ; only those students who are medically pronounced unfit should be exempted. The University should insist upon certificates of physical training from candidates seeking admission to its examinations.

It is much to be regretted that many of our schools and colleges, specially those located in Calcutta, have not got their own playgrounds. It should be the duty of every school and college authority to provide for a playground for the pupils either within the school premises or outside it but not at too great a distance from it, and at least 30 square feet should be available for each pupil. It may be difficult to make such a provision in Calcutta where the price of land is very high ; it would not be difficult, however, to make suitable arrangements in the suburbs of Calcutta.

The Scottish Churches College has got a well-equipped Gymnasium and has also made

good arrangements for outdoor sports. The other day I attended the interesting annual display of the Gymnasium of this College. The Secretary in his annual report regretted that out of a strength of about 1,000 College students, only forty were members of the Gymnasium. On enquiry, I learnt that about 100 more students took part in the outdoor games. Although it is disappointing, I believe it is a better record than most Colleges in Calcutta can show. I was very glad to hear that the College had completed its arrangements for making physical exercise compulsory among the First Year students numbering about 300. I congratulate the College on its wise decision. That arrangement means that at least 300 boys will regularly receive some kind of physical training annually in this College alone. I hope the good example set by this College will be followed in other institutions.

(2) Posture.—The next defect noticed was the *posture* of students. A large number (about 41%) showed *stooping posture* and this was most marked in younger students. For this, the school and college authorities are more to blame than the students themselves. The kind of seats and desks provided for in most of our schools and many of our colleges are designed without any regard to physiological and hygienic considerations. Most of the schools have no provision for suitable seats and desks. Boys made to occupy such

uncomfortable seats for hours, necessarily feel cramped, fatigued and uneasy. Some of the muscles of the body are over-strained, while others remain inactive. The inevitable consequence is that the boy cannot keep himself in an erect posture but bends forward, drops his head, raises his shoulders in the act of supporting the weight of his body by his hands placed on his thighs, and this, repeated day after day, produces structural changes in the bones and muscles and he permanently acquires a stooping posture. Again pupils in any class vary considerably in height but inspite of that, they are all made to sit on benches and use desks of one and the same height which are fixed and unalterable in position. Such an arrangement is neither conducive to convenience nor comfort of the pupils. The desks are often not inclined and, therefore, unsuitable for both reading and writing purposes. The seat-arrangements are most defective in our schools ; hence the stooping posture is more marked among younger students coming fresh from schools than among older boys whose posture improves under better seating arrangements in their colleges.

Great attention is being paid to seats and desks in schools in Europe and America during recent years It is now recognised that each pupil should have a separate seat and desk for himself, and both the seat and desk should be of an adjustable type, so that they could

be raised or lowered to fit the height of the pupil. The feet should firmly rest on the ground and not dangle in the air. There should be a mechanism to change the slope of the desk which should be at an angle of 15° for writing purposes and it should be on a level with the elbows of the pupil. Seats should be provided with a back rest and grooved or hollowed to prevent pupils from sliding forward. The correct and easy posture in writing is that the shoulders should not be raised, the head should not drop forward nor the spine bent.

Most of our schools and colleges are barely self-supporting and it cannot be denied that financial difficulty stands in their way of providing hygienic seats and desks for their pupils. A beginning should, however, be made in all Government schools and colleges and in well-financed non-Government institutions to provide pupils with separate adjustable seats and desks.

Most of our students do not use table and chair at home for purposes of study but generally squat on the floor or on a bedstead and read and write by placing the book on their lap. It is needless to say that this is a very faulty posture and leads to stooping. In such a case, a desk or a small stool of suitable height should be placed in front as a book-rest, so that reading and writing may be done on it in an easy and erect posture. Reading and writing in a lying position should be avoided as it produces fatigue, induces muscular cramp and is bad for the eye.

Students at the time of giving their lessons in the class room or when working exercises on the black-board should stand with head erect, with both feet firm on the ground and with both shoulders and the hips on the same level. They should not bend their head to one side or raise one hip or shoulder on a higher level than the other.

(3) **Eye-sight.**—Another very common defect noticeable in our college boys is *defective eye-sight*. It was noticed in 36 per cent. of the students examined by the University Health Committee and a very large number of them did not use glasses to correct it. The error was of a refractive nature (either short or long sight) and could be corrected by the use of proper glasses. Improper lighting of class-rooms and of study-rooms at home, defective posture due to ill-suited benches and desks, unsuitable artificial lights used during night and sometimes a desire to put on glasses where they are not required, are some of the main factors which induce refractive errors in vision. No doubt, the defect is natural in some cases but their number is very small. If the defect is recognised and attended to early, not only further mischief may be prevented but in not a few cases complete cure may be effected. One of the good results of the medical inspection of a school is that as soon as the defect is found out, the boy is at once advised by the medical inspector to consult a specialist and use the proper kind of glasses prescribed by him. It

is satisfactory to note that the Calcutta University has made arrangements for the supply of glasses at cost price to poor students when recommended by their medical attendants. Some of the class and reading rooms in many schools and colleges are very badly lighted. In cloudy days, the trouble is most felt and it causes a heavy and damaging strain on the eyes of the young readers. I regret to say that the Calcutta University is not above blame in this matter. The reading room in the Durbhanga Library is so dark that even on a bright sunny day, the best-sighted students cannot read there without much strain on their eyes and very often they require the help of artificial light. This is much to be regretted, considering that a large number of young men daily pass several hours there availing themselves of the rich and rare collection of books in the University Library.

For the proper lighting of a class-room, the window-space should be at least one sixth of the floor-space. They may be placed at about four feet above the floor but should be high, as about one-third of the light comes from the upper part of the windows. The light should come from the back and sides, preferably from the left side of the pupils which would thus prevent their shadows falling on books.

Many class-rooms are not only ill-lighted but also inadequately ventilated. The vitiated air of a stuffy class-room poisons the blood

of the pupil and makes him dull, tired, inattentive and sleepy. It favours the spread of tuberculosis and other infectious diseases of the lungs. Pupils should be permitted to go out in the open air for about ten minutes after each period. Weather permitting, it is best to hold open-air classes under shady trees where the school or college possesses a big compound.

The use of proper glasses would no doubt rectify refractive errors. But as prevention is always better than cure, one should try his best to avoid those causes which lead to defective vision. Some of the rules and conditions which are helpful to preservation of good sight are noted below and it would be best for all of us to observe them as strictly as possible. All school and college authorities should take early steps to improve those unfavourable conditions existing in their institutions which injure the eye-sight of the pupils.

(1) Reading in insufficient or too strong light is bad for the eye. The illumination should be such as neither to strain nor to pain the eye.

(2) Ill-lighted class-rooms injuriously affect the eye-sight and are responsible for many a case of defect of vision in our students. In a class-room, the seats should be so arranged that puplis should not face the openings for light (to avoid glare). The seats should be at right angles to the windows and most of the light should come from the windows on the left side of the pupils and from

the back. There should be sufficient light in the room to enable a pupil with normal eyesight to read small print in any part of the class-room at a distance of a little more than twelve inches from the eye.

(3) When using artificial lights, they should be placed at the left-hand side and back of the pupil or hung from ceilings protected with shades. Such an arrangement would help avoiding glare and shadows falling on books. All artificial lights should be covered with shades of a green or grey colour. Electric lights are best for reading and also on hygienic grounds as they do not pollute the atmosphere. Next best is gas-light and then come the kerosene lamps. The dim light of *chenaks* is not good for study; their dimness causes strain to the eye.

(4) Small types are most injurious to eye-sight. Books in small print should never be used by boys. The Text-book Committees and the Boards of Studies in the University should bear this in mind in selecting books for our boys. The indistinct, blurred and close printing of some of our Indian newspapers cannot be too strongly condemned. Guardians and teachers should keep an watchful eye on this matter.

(5) One of the golden rules for preserving the fitness of vision is not to read a book in a lying posture (on back). In reading, the natural position for the eye is to be *above the book* and *not under it* which causes strain and fatigue. This is well illustrated by the strain and discomfort one experiences when he looks at a picture above his head even for a short while.

(6) It is the practice with many people to read a book or newspaper while travelling in a railway carriage or in other vehicles. This is not good for the eye which has to alter its mechanism continuously in order to adapt itself to constant up and down positions of the book caused by the jolting of the carriage. The object must be at a fixed place in order that the eye may have a clear vision of it. If the object moves and frequently changes place, the mechanism of vision will also require constant change in order that the eye may adapt itself for clear vision to the changed position of the object and this produces severe strain and fatigue to the eye. Reading while travelling should, therefore, be discouraged as much as possible.

(7) And lastly, complete rest should be given to the eye as often as possible. Even during study, eyes should from time to time be taken away from the book and applied to objects situated at a distance. This alone will give much relief and will minimise the bad effects of strain. The eye-sight of village-students is generally better than that of city-students. The latter have constantly to fix their eyes to close objects, to the white walls of their rooms and to white and grey buildings of the town, whereas the village-boys enjoy the distant and soothing sight of green fields, clusters of green trees open blue sky and the beautiful broad landscape bordering on the horizon. Illiterate people suffer less from defects of sight than educated people owing to constant strain on the organ of vision caused by reading and writing. It is best for townspeople to go as often as possible to muffusil in order to give to the eye a feast of woodland sceneries.

II. Personal Hygiene.

It will not be out of place to make a brief reference here to personal hygiene which is often neglected by our students. To those who have occasions to come into contact with our students living in messes and hostels, there is often perceptible a general neglect and disregard of cleanliness of body and of clothes and beddings and a want of tidiness of the rooms they live in. Baths perfunctorily performed, teeth not properly looked after, food hastily gulped down, brain over-worked, exercise avoided and hours of sleep cut down for the sake of study or amusement and even calls of nature not timely attended to,—these are some of the common occurrences of student-life in Bengal and require to be remedied. You should remember that the habit of cleanliness is not instinctive but has to be acquired. The parents should inculcate this good habit in their children from a very early period, so that it becomes second nature to them as they grow older.

Baths.—Our boys do not properly understand the great physiological function of the skin as one of the main drains of the body for the removal of waste and poisonous matters which are constantly accumulating within it. They ought to spend more time over their baths. In a hot country like ours, a morning and an evening bath should be regularly taken (except in the cold weather) and soap

should be freely used to remove all grease and dirt from the skin, so that its pores remain open and patent. Cold baths are invigorating and refreshing and they are best for all people except for those of delicate constitution.

Teeth.—The teeth do not receive that amount of attention which they deserve. We Indians are generally credited with having good rows of teeth, but I am afraid that, owing to our neglect, we are soon going to lose this credit. The recent enquiry by the University Health Committee shows that about 33 per cent of our students suffer from defective teeth. This, I should say, is a bad record for young people and every effort should be made to remedy the defect. A good set of teeth is not only a sign of beauty but is an absolute necessity for good digestion and, therefore, for preservation of health. Neglect of teeth give rise to tooth-ache and gum-boils which are extremely painful ailments; loss of teeth and pyorrhæa follow which lead to serious digestive and intestinal disturbances.

Teeth should be cleaned regularly with proper materials (tooth-powder, brush or sticks) twice a day and also after finishing each meal. Too much chewing of *pan* (betel leaves) is bad for teeth and is a dirty habit. Those who are accustomed to take *pan* should take it moderately.

Spitting.—Spitting here, there and everywhere is a dirty habit and should be stopped. It also favours the spread of that terrible disease known as *consumption*. Spittoons containing a little phenyle should be kept at convenient places to receive all spittle.

Smoking.—If any of you has contracted the bad habit of smoking, I would earnestly advise you to give it up at once. Smoking in the growing period of life injuriously affects some of the vital organs, and if persisted in, may produce permanent organic mischief. It is a great drain on your purse too.

Drinking.— I need not say anything about alcohol. Its pernicious effects are well-known. Fortunately, our student community is practically a stranger to the use of alcohol.

Meals.—Food is eaten with much haste by our young men. It is looked upon by them as a business that had best be finished as soon as it is begun and as a rule, they do not seem to enjoy their breakfast and dinner. The function is discharged as a matter of routine and is not looked upon as an enjoyment of life. The evil effects of such quick eating are indigestion, ill-health and much waste of good money. Food should be slowly taken in and well-chewed. This greatly aids digestion, helps assimilation and throws less labour on the other organs. It prevents waste and satisfies the appetite with

a much smaller quantity of food than if it is quickly swallowed.

An interval of five to six hours should be allowed to elapse between one full meal and another in order to allow the system to properly digest what has been taken in. We, Indians, eat our food with the aid of fingers which should be cleaned thoroughly before touching the meal. The dining room should be kept dry, clean, well-lighted and well-ventilated, free from bad smell, dirt and flies. Dust and flies frequently carry infection to food. There should be regular hours for meals and all boarders should sit down together and take their food while it is hot. Cold and stale food is bad for digestion and may become infected.

Clothings, beddings and bed-room.—You should pay greater attention to your clothings and beddings in respect of cleanliness. They should be frequently washed with soap and water and more often sunned and aired. The room in which you live should always be kept neat and tidy and all things there should be in order and each in its proper place. It should be free from dust, dirt, cobwebs and flies. The doors and windows should be kept open day and night—only draughts are to be avoided. There should be no over-crowding. For each boarder, a floor space of 60 square feet at least, preferably 100 sq. ft., should be provided in the bed-room.

Study.—Do not overwork but work regularly and methodically. If you adopt method in your work, you will not have to over-work yourself during the examination time and your success will be assured.

Physical Exercise.—I have already told you that physical exercise in some form or other is necessary for all persons at all ages. It is as indispensable as food and sleep. You should shake off your apathy and take interest in outdoor games and other kinds of exercises. It will give you health, strength and power of endurance and invigorate your mental faculties. You all know the Latin proverb which says that a sound mind lodges in a sound body.

Recreation and Sleep.—You require rest after work and good and sound sleep at night. Seven to eight hours' sleep is quite enough for people of your age. You must not grudge the time you spend over these physiological needs of the body. Light reading, recitations, music and other innocent recreations give relaxations to an over-worked body and mind, but you must avoid reading such literature and attending such entertainments as are likely to poison your young and innocent minds.

III. Brahmachariyia (Self-control).

The great secret of maintaining health and strength and of enjoying a spirit of perpetual youth is the practice of *Brahmachariyia* from a very early period of life and every thing that goes to weaken the practice should be scrupulously avoided.

You must not allow bad or impure thoughts to dominate your mind ; you should always try to displace them by pure and ennobling thoughts. Real success in life, physical, intellectual, moral and spiritual, follows the practice of *Brahmachariyia* (Self-control) and our scriptures enjoin that it should be practised in all its minute details in our student-life. *Brahmachariyia* is the precious heritage left to us by the sages of ancient India. It made them great in knowledge, in virtue and in power. We have fallen from the high standard and that is the cause of our present degradation and misery. Banish all impure thoughts, avoid impure literature and unwholesome pleasures and amusements that pander to animal passions, give up all vicious and sinful habits peculiar to student-life, exercise control over your passions and desires, lift up your hearts in prayer to God,—then each of you will be a young *Brahmacharin* in the true sense of the term. Then only you will yourself be great and you will help in the formation of a great and mighty nation.

Use of Chlorine as a Disinfectant of Drinking Water for Calcutta.*

In the first place, I desire to emphasise the principle, now universally recognised, that the addition of an antiseptic or disinfactant to any food or drink should as far as possible be avoided, as the prolonged use of such substances is harmful to the body. On this point, reference may be made to what Sir Arthur Newsholme (a very high authority on the subject) says with regard to the chemical purification of drinking water :—

"Chemical processes for the purification of water, with the exception of the softening process, are not recommended for general use. Efficient filteration and boiling is safer than chemical treatment, and it would only be justifiable to trust to the latter, where, as in a military campaign, an attempt at purification was necessary and no means were available for filtering or boiling water."—HYGIENE AND PUBLIC HEALTH.

* This note was addressed to the Secretary to the Corporation of Calcutta in 1921 on a reference having been made by him to Dr. Bose as to the desirability of using *chlorine* as a disinfactant for purification of drinking water supplied to the town of Calcutta.—*EDITOR.*

It, therefore, follows that in the case of drinking water which is daily consumed in large quantity by the population of a city, this question assumes a grave importance and demands very careful consideration. In such a case, unless the matter is of extreme urgency and necessity, no justification could be had for the employment of disinfectants. The point to be first determined, therefore, is whether such an urgency or necessity has arisen in the case of the water-supply of Calcutta.

From a persual of the weekly reports of the analysis of drinking water, chemical as well as bactoriological, supplied to Calcutta during 1920, I am convinced that such an urgency has not arisen. The bacteria-removing power of the purifying process adopted by the Calcutta Corporation is extremely satisfactory, the reducing power being always above and never below 99 per cent, and not a single bacillus of the Colon Group has been seen in 10 c. c. of the filtered water during the whole year.

The water-supply system of Calcutta came into existence in 1870, and during the last 50 years, so far as I know, not a single epidemic of cholera or typhoid fever in Calcutta has been directly traced to the use of filtered water. Many epidemics of cholera,

on the other hand, are believed to have been caused by the use of unfiltered water and it is satisfactory to note that the Corporation has decided to put a stop altogether to the supply of unfiltered water.

In regard to the opinion of the Health Officer that the polution of the river-water is increasing, it may be stated that public opinion supports this view. The remedy, however, lies in adopting necessary measures for preventing increased polution of the river. The throwing of imperfectly treated sewage into the river for several miles along its banks on both sides is rightly considered as a great public nuisance, and a River Polution Act should be passed either enforcing the diversion of the sewage to cultivated fields for purposes of manuring, or making the throwing of sewage into the river impossible unless it is so efficiently disinfected as to make it entirely free from infecting germs. This polution of the Hugli water is a much larger public question and is a matter of grave importance to people living outside Calcutta on both banks of the river. If it could be satisfactorily tackled, a very large population living on the river banks will enjoy considerable immunity from periodical visitations of cholera. However that may be, there are no proofs at present forthcoming to support the statement of the Health Officer that the present system might fail in case of

increased polution of the river. For this, the maximum bacteria-removing power of the existing system of purification should first be accurately ascertained before a definite opinion could be given as to the exact limit of its efficacy. From the figures supplied by your office, it is plain that the purifying power of the present system did not at all suffer with the increase of polution. If you will please refer to the report for the week ending 11th December 1920, it will be seen that the bacteria-reducing power was 99·75 percent when 11000 bacteria were present in 1 c.c. of river-water, whereas in the report for the week ending 26th June 1920, we find that the bacteria-reducing power was higher (being 99·99 percent), although the bacterial count in 1 c.c. of river water was 1,250,000, which means more than one hundred times increased polution. There is at present no good ground to apprehend that the efficiency of the present system will fail if the number of bacteria in the river-water rises to a higher figure.

The chlorine method of purification of water as recommended by the Executive Engineer of the Calcutta Water Works, is modern and believed to be thoroughly efficient. It is superior to the *bleaching powder method* which is still in use in many places. Chlorine, although possessing high bactericidal properties, is a poisonous substance. It has a bad taste and smell and has a very irritating action on mucons mem-

branes of both the respiratory and digestive tracts. Unless it is used in such quantity as just sufficient to destroy bacteria only, but not remaining in excess in the drinking water, it might prove to be an inconvenient and harmful remedy. Very great care will, therefore, be required to regulate the dose of the disinfectant, and the disinfected water should have to be regularly tested by an expert to ensure the absence of chlorine from it before it is allowed for drinking purposes. On this point, I would quote the following opinion :—

"Chlorine and hypochlorites have been used in times of emergency to destroy the pathogenic germs that might possibly have found their way into the service-water. But as chlorine is easily held in solution by water, and as a very small proportion of that gas produces a disagreeable effect on the palate, there has always been a disposition to make the use of this disinfectant as brief as possible" *Modern Methods of Water-purification by Don and Chisholm.*

With reference to the use of chlorine as a water-disinfectant, Dr. Houston observes that in the United Kingdom, things have not gone altogether smoothly, there being among the public an almost invincible repugnance to the use of chemicals (except lime) in connection with water-supply.

There are, therefore, great draw-backs in the use of chlorine as a disinfectant of drinking water. It should, in my opinion, be resorted to in exceptional cases only, as in military campaigns when efficient filtration of water

can not be carried out, or in times of outbreaks of epidemics of water-borne diseases such as cholera &c., where it would be necessary to use chlorine temporarily to prevent the spread of disease through infected water.

I am, therefore, of opinion that no good case has been made out for the immediate use of chlorine for the purification of drinking water supplied to the city of Calcutta. Expenses certainly are of no consideration where the safety of human life is concerned but I submit that no such grave necessity has arisen as to justify the experiment now proposed. I would not recommend the introduction of the new method unless the count of bacteria in 1 c.c. of the filtered water rises above 100, or the bacilli of the colon group are found in 1 c.c. of the filtered water. The latter are not found now even in 10 c.c. of the filtered water supplied to Calcutta.

TEMPERANCE

Physical Effects of Some Intoxicating Drugs.*

I propose to place before you this evening a short account of the physical effects of some of the common intoxicating drugs partaken of by the people of this country. These are alcohol, opium, cocaine, Indian hemp and tobacco.

At the outset, I should tell you as a medical man that none of these drugs is necessary for the human body in conditions of health, but they, perhaps with the exception of tobacco, are valuable medicinal agents and are indispensable to the physician in the treatment of certain diseases. I am myself a teetotaler and have the greatest aversion against the use of any of these drugs except as medicine. It must not, however, be supposed that this aversion is the result of any ill-founded prejudice against these intoxicants. It is a conviction based on my long experience as a medical man, as a

* An address delivered at a meeting of the Calcutta Temperance Federation on the 24th November, 1915, at the Y. M. C.A. Hall, College Branch, Calcutta, and published in the Calcutta Medical Journal December, 1915.

Chemical Examiner, and also as a member of the community. There are many who hold that moderate doses of any of these intoxicants, specially alcohol and opium, do not produce any ill effect on the system. But even those that hold this view are constrained to admit that it is very difficult to keep to a moderate dose for any length of time, because one of the physiological properties of these drugs is to induce a craving for increased doses. Many a sad case are known in which the habit of drinking or opium-taking began with small doses only, often under medical advice, but which continually went on increasing till the sorrowful end came in with the termination of a valuable life or the incarcération of the victim in a lunatic asylum.

Moreover, long continued use of alcohol, even in moderate doses, undoubtedly produce pathological changes in the system, particularly in the nerve-tissues. These changes may not markedly affect the conduct and action of the individual in the performance of the ordinary duties of life or may not even prevent him from attaining to the average limit of human life; but a closer and careful examination would not fail to discover that the prolonged imbibition of alcohol, for example, even in small doses, dulls the natural sensibility of the nervous system, affects the temper and

destroys the fineness of thought, reason and judgment.

I would now take up the drugs individually and begin with alcohol.

Alcohol.

Local action.—Alcohol has both a local and a general action. When applied to the skin, by rapid evaporation, it produces a sensation of cold. Mixed with equal parts of water, it is applied locally as a cooling lotion to reduce heat and the flow of blood in an inflamed part. If evaporation is prevented, it irritates the part causing a sensation of burning. A similar irritant effect is also produced on the lining tissues of the mouth and stomach when drunk. If the dose is small and is well-diluted, it causes an increased flow of saliva and gastric juice, induces a feeling of appetite and is believed to be helpful to weak digestion. Such feelings are, however, in many cases very deceptive, as I shall try to show later on. In larger doses, it causes irritation of the lining tissues of the stomach, producing congestion and stopping the free flow of the gastric juice. It also precipitates the protein constituent of the food (such as is contained in meat, fish, eggs, milk &c.) present in the stomach and renders it insoluble in water, thus preventing its absorption and utilisation in the system. It also gives rise

to an unhealthy secretion of mucus in the stomach which very much retards digestion.

General action.—Alcohol is taken as malt-liquors, as wines and also as ardent spirits. Beer, stout and porter belong to the class of malt-liquors ; claret, port wine, sherry and champagne belong to the class of wines ; whisky, brandy, rum and gin belong to the class of spirits. The spirits contain the largest proportion of alcohol—from 35 to 60 per cent, wines from 10 to 20%, and malt-liquors, such as beer, from 3 to 6%.

Alcohol is very quickly absorbed by the stomach and reaches the blood within a few minutes ; within 15 minutes, the maximum quantity is found in the circulation. After absorption, its action on the different tissues and organs of the body is very well-marked. It is taken up by the blood and there it enters into combination with its red colouring matter (hæmoglobin). Now the principal function of this red colouring matter of blood is to take up oxygen from the inspired air, carry it to all parts of the body where slow burning takes place with its help, producing heat and energy so necessary for the maintenance of life. Oxygen is the great purifier of blood, and when for any cause, we do not get the proper quantity of oxygen, the blood gets impure and the whole system gets poisoned. This compound of hæmoglobin with alcohol makes it less capable of absorbing oxygen ; it

thus interferes with the proper oxidation of the tissues and food which is an essential condition of health.

Alcohol as food.—Alcohol, after absorption, gets burnt in the blood producing carbonic acid gas and water. This fact of alcohol getting burnt in the system in a way similar to certain kinds of food, such as sugar, has given rise to the hypothesis that it acts as a food and may be used as its substitute. There is, however, a considerable difference of opinion among physiologists as to the value of alcohol as a food. Without entering into a detailed discussion of the subject, I think I am not too far from the mark when I say that even admitting that alcohol, (being a fuel) may serve some of the functions of food, it is after all a very poor substitute for ordinary food, both on physiological and on economical grounds, and in this connection, I would refer to the humorous observation of a well-known writer who calculates that the nourishment contained in a gallon of beer which would cost you not less than 3 to 4 rupees is just equal to a lump of sugar worth one pice only. I cannot do better than quote here the opinion of Sir Victor Horsley who defines food as "a substance which, when absorbed into the blood, will nourish, repair waste, and furnish force and heat to the body without causing injury to any of the parts or loss of functional activity." He holds that alcohol is not a food,because

it fails to fulfil most of these conditions. Alcohol does not possess the power of repairing tissues. The mere fact of alcohol being oxidised in the body and producing heat like some food-stuffs does not prove that it is a food. Poisons like morphine and phosphorus, when intrduced into the system, are oxidised by the tissues—that being one of Nature's efforts to get rid of the poison from the system—but this fact would not justify our placing morphine among food-stuffs.

Sir Jas. Barr, M.D., affirms that "alcohol is not a food in the proper acceptation of the word," and Col. C. H. Melville, in his "Military Hygiene and Sanitation," truly observes that "in actual practice, alcohol cannot be used as a food, since in quantities sufficient to produce any substantial supply of energy, the effects on the cerebral nervous system would be so great as to completely neutralize any good effect so produced."

Sir Lauder Brunton says that "in certain circumstances, such as febrile conditions, alcohol may be a very useful food but in health, when other kinds of food are abundant, it is *unnecessary*, and as *it interferes with oxidation, it is an inconvenient kind of food.*"

Effect on the general circulation and blood-vessels.—The first effect of absorbed alcohol is to cause the heart to beat more rapidly; the pulse-rate is consequently increased. It also

causes dilatation of the blood-vessels distributed over the surface of the body followed by an increased flow of blood to the surface; the skin of the face and hands thus becomes more flushed and of a uniform pink colour and the nose and eyes look red. In habitual drinkers, the blood-vessels become permanently dilated and enfeebled and any sudden strain on them, as in a fit of anger or excitement, may cause them to give way, producing bleeding iu the brain or in the lungs which may speedily terminate fatally.

One of the effects of this free flow of blood to the the skin is the lowering of the temperature of the body. The more the warm blood circulates in the skin, the more it is subjected to the cooling influence of the surrounding atmosphere. Evaporation from the skin at the same time goes on, particularly as much perspiration follows the ingestion of alcohol. The result of all this is to reduce the body-temperature. The lessening of oxidation of the tissues already referred to also considerably helps the reduction of body-temperature.

At one time, it was believed that alcohol had a protecting influence against cold. This probably originated from the first sensation of glow and warmth, which is felt soon after taking alcohol, by the increased flow of blood to the surface of the body, but this is only a temporary effect which soon passes off, followed by permanent loss of heat from the body. People soon

found to their cost that drinking alcohol previous to exposure to severe cold was always attended with serious and even fatal results. I quote the observation of Sir Lauder Brunton bearing on this point :—

"Normally, when a person is subject to cold, the vessels of the skin contract and prevent the warm blood in the interior of the body from approaching the surface and thus becoming cooled; but when large quantities of alcohol are taken, this mechanism becomes paralysed, the blood from the interior circulates over the surface and is cooled down more and more *until its temperature becomes so much reduced as to be incompatible with life, and the patient is frozen to death.* The dangerous effects of alcohol under such circumstances are well-known to the lumberers in Canada and to Arctic voyagers who dread alcohol and generally avoid it altogether."

Effect on the Brain.—On the brain, alcohol temporarily produces a stimulating effect due to increased flow of blood in that organ. The functions appear to be more active and there seems to be a rapid flow of thoughts which could be expressed more fluently. But this is, after all, a question of surface only at the expense of depth. As Sir Victor Horsley observes, the man may appear to himself and to his friends who are drinking with him as "brilliant," whereas his thoughts are really superficial. In July 1915, Sir Lauder Brunton thus expressed himself on this point in the "Nineteenth Century" :—

"My friend, the late William Black, the novelist, once told me that a single glass of sherry was enough to take the fine edge off his intellect. Under its influence, he seemed to himself to write more fluently, quickly, and eloquently than usual, but the manuscript he then produced would not stand criticism next morning.

"This effect of alcohol in making a person feel better, cleverer, and stronger than he is in reality, is one of the pleasures which alcohol affords and is an inducement to its use. It also lessens the weight of care due to external circumstances. This, I think, was very well put by a very able and admirable man whose professional work entailed a great deal of correspondence.

"One night, when dining with a friend after a long and exhausting day, he partook freely of champagne, and at the same time lamented the piles of letters which were lying unanswered upon his table. His friend said to him, "this champagne will not help you to answer letters." "No," said he. "but it will make me feel that I do not care a *damn* whether they are answered or not.

"When I began to write this anecdote, I felt inclined to leave out the oath, because it is quite unnecessary, but on second thought, I decided to have it, because its employment shows that the narcotic action of alcohol was already reaching the further stage when the subject was not only ceasing to regard the dictates of his own conscience but was becoming careless of the opinion of those around him. When this state is fully developed, a man under the influence of alcohol will do and say things which, in his sober moments, he would condemn with contempt and disgust. He becomes more self-centred, more regardless of his environment, present or future, until finally he becomes drowsy and falls into a deep sleep. Several hours afterwards, when the alcohol has been eliminated, he generally wakes from this sleep, wretched and miserable, and is tempted to relieve the depression by again taking another glass of spirits, and thus making a further drop on his resources.

"As the alcohol tends to lessen foresight and care for his surroundings, the subject of alcohol becomes more and more ready to indulge, inspite of the indulgence bringing with it failure, poverty, and misery, not only for himself but for all his family."

The actual effect of alcohol on nervous centres, according to Sir Lauder Brunton, is "one of progressive paralysis, affecting them in the inverse order of their development, the highest centres being affected first, and the lowest last. Thus the power of judgment usually goes first, while imagination may be timely, and the emotions more than usually active, so that after a man becomes incapable

of discussion, he is combative, affectionate or lachrymose. The centres governing the movement of the muscles are next affected, the speech becomes thick, hesitating and uncertain, the gait becomes unsteady, and ultimately the man is unable to walk. The vision may also be affected. The respiratory centre is next paralysed, first showing slow and stertorous breathing and ultimately it stops, although the heart may still continue for a short time, but the heart may also stop owing to paralysis of its nervous mechanism,"

Effects on the Stomach and Bowels.—In a confirmed drunkard, nearly all the internal organs soon show signs of degeneration. The lining tissues of the stomach become thickened and permanently congested ; a large quantity of unhealthy mucus is secreted by the stomach, appetite is lost, digestion is retarded and one of the commonest symptoms exhibited by a confirmed drunkard is vomiting immediately after rising from bed in the morning. In regard to the popular belief that alcohol aids weak digestion, Dr. Chittenden of the Yale University observes that "with a weak gastric juice where the amount of ferment present is small and the digestive action consequently slow, or where the proteid material used is difficult of digestion, the retarding effect of a given percentage of alcohol is far greater than when the digestive fluid is more active."

Sir Victor Horsley says that "all the evidence shows that, just as strong solutions of alcohol are more or less rapidly harmful to the digestive organs, so smaller doses are liable ultimately to affect these organs in a slower though similar way."

The bowels are also unhealthy and looseness is a common symptom.

Effect on the Liver.—There is much congestion of the liver in the beginning making it somewhat enlarged and tender, followed by degeneration of its cells and increase in the growth of its fibrous tissues which ultimately contract and produce a condition what is commonly known as '*cirrhosis.*' The liver ultimately becomes much smaller in size and studded with nodules on the surface. This peculiar appearance has given it a special name viz., the 'hob-nailed' liver ; it is also known as the 'drunkard's' or 'gin-drinker's liver.' The effect of the contraction of the liver is to stop all flow of blood through it from the stomach and the bowels. As a result of this obstruction, the watery fluid from the blood oozes out in large quantity into the abdominal cavity, the abdomen becomes swollen and abdominal dropsy (*Ascites*) is thus caused. The obstruction to the circulation through the liver causes much stasis of blood in the stomach and intestines at a high pressure, and we often find in such

cases rupture of blood-vessels in the stomach or intestines giving rise to blood-vomiting or hæmorrhage from the bowels. Such bleeding may be profuse, and generally ends fatally in the second or third attack, if not, in the first.

Effect on the Kidneys.—The kidneys become irritated by part of the alcohol leaving the body through them; they show congestion and enlargement in the beginning, followed by contraction giving rise to permanent injury to the organ in the form of contracted or cirrhosed kidney. This diseased condition of the kidneys causes swelling of the face and the limbs and presence of albumin in the urine. It is an incurable disease and carries off the patient within a few years, if not months.

Effect on the Heart.—The heart does not escape the ravages of alcohol. In Hill's Textbook of Physiology called by Schafer, alcohol is mentioned as a "drug which, while it renders systolic output incomplete, increases the diastolic pressure and the dilatation of the heart."

Sir Hernam Weber, M. D., F. R. C. P., observes that "alcohol weakens the heart, causes hypertrophy and dilatation and fatty degeneration of the muscular fibres, and that thus it increases the natural tendency to failure of the heart which is usual in old age."

Sir Jas. Parr, M. D., goes further and says that "alcohol has a somewhat similar effect on the heart to that produced by the typhoid poison."

Delerium Tremens.—Finally, the mental powers become impaired, the memory fails, the power of concentration is lost, and the victim becomes indifferent to everything around him; a tremor is seen in the tongue, lips and hands, and he often suffers from severe pain in the limbs due to inflammation of the nerves (neuritis). Delerium tremens may also set in, in which the man imagines that he is surrounded by horrible animals, such as snakes, rats etc; he hears imaginary voices or believes that he is tormented by demons, often of a blue colour, from which he tries to run away. This has given the name of "*blue devils*" to this disease. It is a horrible disease, and you cannot form any idea of the terrible sufferings of the patient and the utter wreckage of his nervous system unless you have seen a case yourself. I well remember the case of a medical man, a confirmed drunkard, who suffered from delerium tremens. Although wide-awake, he was practically unconscious to all his surroundings. He had no sleep for days and nights together, and although carefully guarded, he managed to escape one day, and stark-naked ran for half a mile from his house to the river-side and plunged himself into the river but was timely rescued by people bathing at the *ghat* at that time. That man, I am glad to say, gave up alcohol after this and lived a good many years in apparently good health.

Alcohol and Insanity.—Such symptoms often

lead to permanent insanity in the victim, who at last finds refuge in a lunatic asylum for the remaining days of his earthly life. In about 50 per cent of the cases admitted in Asylums in England, the previous history points to indulgence in liquor.

The drinking of excess of alcohol may, as we have seen, lead to insanity. The craving for drink may, however, be the effect of a form of insanity which we call '*dipsomania*.' When a person suffers from dipsomania, he shows a morbid tendency to take drink. This weakness may come as a hereditary transmission; it may also be the result of emotional state and enfeeblement of moral control which marks the onset of many forms of mental disease. "The victim loses self-control and regard for truthfulness; he will resort to any subterfuge to gratify his cravings and will lie in a most bare-faced manner to extricate himself when in a difficulty. Such people are pests to their families and to society at large."

Alcohol on Young people.—Young people are particularly susceptible to the action of alcohol. In their case, alcohol exerts a retarding influence on their growth and development and makes them less strong and less healthy for life. Experiments made on plants and lower animals point to the injurious influence of alcohol on growing vegetable and animal life. Seeds and plants, treated with a very dilute solution of

alcohol, exhibit stunted growth and diminished functional activity. Young animals fed with small quantity of alcohol were found to suffer much in their growth and activity when compared with their fellows placed under similar conditions of food and hygienic surroundings, but without alcohol. We need not be surprised at this, because alcohol is a poison to protoplasm which is the basis of all vegetable and animal life.

As regards allowing alcohol to young people in any form, Dr. G. Rankin says that "the stern forbidding of alcohol and tobacco under the age of puberty would shield the nervous centres from two of their most deadly ememies." Baudelier and Roepke very rightly observe that "above all, parents and educators must be shown that alcohol does not build up but destroys tissues, and that alcohol *in any form* or *any quanity* must be forbidden to children and youths. If they are allowed to alcohol regularly to strengthen them or for other reasons, a race of candidates for consumption will be produced. So the fight against tuberculosis includes that against alcohol."

Alcohol and Heredity.—This weakness in body and mind does not unfortunately, remain confined to the sinners themselves but carried down to posterity, to the second, third or even unto the fourth generations.

Prof. Clifford Allbutt asserts that "drunkenness is most distinctly hereditary. It seems to me to be a very strong hereditary tendency to a special craving." Prof. Adami, in his address on the "Study of Eugenics," has observed that "in the body, the germ-plasm is capable of being influenced by physical and chemical agents. This is evidence of first importance for medical men. We have long observed that intoxicants affecting the body of the parent are liable also to affect the germ-cells." Prof. Clifton Edgar, in his "Practice of Obstetrics," says that "alcohol in the fœtal circulation tends to arrest the highest development." Mothers, partial to alcohol, should take a warning from this.

Insanity, epilepsy and other terrible nervous diseases are more often found in the progeny of drunkards than among the children of total abstainers.

Alcohol and Crime—Speaking on the relation between alcohol and crime, Judge Rentoul reiterates the opinion of several of the greatest judges that "90 per cent of all the crimes they have tried arises from drink." It has also been found, in tracing the family history of criminals, that in a good many cases, the history of heavy drinking existed in the parents or in previous generations. By taking alcohol, we thus not only make ourselves unhappy and miserable, but our

children also and their children too, by leaving to them a terrible legacy which cripples the family for generations to come. On its sociological aspect, Lord Gorell, late President of the Divorce Court, has stated "that he is firmly convinced that if drink were eradicated, his court might shut its doors, at any rate, for the greater part of the time."

Alcohol and Criminal Responsibility.—With reference to drunkenness and criminal responsibility, the view that law takes in such matters is that a crime committed during drunkenness is as much a crime as if it were committed during sobriety. The prisoner is supposed to know the effects of drink, and if he took away his senses by means of drink, it is no excuse at all. The case is otherwise if the man has been made to take alcohol by force. If, however, by prolonged drinking, the mind is impaired, the condition is regarded as being on a par with ordinary insanity.

Alcohol and Work.—The popular belief that alcohol increases our strength and power of work is altogether erroneous. Probably the boisterous conduct of the drunkard and his violent antics have something to account for such a notion. It is true that during the stimulating stage, the heart beats faster, giving rise to a feeling of greater strength and activity. This effect, however, rapidly passes away

followed by exhaustion and depression of both the heart and the nervous system. In cases of illness and severe accidents, such temporary stimulation of the heart is of great value and the judicious use of alcohol may avert death from exhaustion and shock. This, however, is the medicinal use of alcohol. We shall be greatly mistaken if we would expect power and strength from alcohol in people enjoying sound health. It has often and often been found, both in the fields of sports and of battle, that the use of alcohol diminishes the total output of work by bringing on early exhaustion and fatigue, and alcohol-drinkers are always worse off than total abstainers so far as staying power, hard work and immunity from disease are concerned. It is believed that in the present terrible European war, the capacity for work in the army of some of the Allies has been increased 50 per cent by the stoppage of alcohol in the rations.

In regard to this point, the experiences of all veteran leaders of the Army and the Navy, English and foreign, past and present, point to alcohol as the great weakening factor both as regards the discipline and efficiency of the Force.

Field Marshal the late Lord Roberts once said—"Give me a teetotal army and I will lead it any where,"

Lt. General Sir Reginald Hart observes that "as an officer, I support temperance because I know that officers and men who avoid drink are physically and mentally more efficient, their nerves are stronger, they march better, there is far less sickness and crime, their power of resistance is strengthened."

Sir Frederick Treves, the celebrated English Surgeon, who was with the army in the Boer campaign, has recorded his experience of the effects of alcohol on the troops in the following terms :—

"As a work-producer, alcohol is exceedingly extravagant, and like all other extravagant measures, leads to a physical bankruptcy. It is also curious that troops cannot work much on alcohol. I was, as you know, with the Relief Column that moved to Ladysmith, and, of course, it was an extremely trying time, by reason of the hot weather. In that enormous column of 30,000, the first who dropped out were not the tall men, or the short men, or the big men, or the little men, they were the drinkers, and they dropped out as clearly as if they had been labelled with a big letter on their backs."

And lastly, I quote Sir J. R. Jellicoe's testimony on this point during the present War. He says that "as regards straight shooting, it is everyone's experience that abstinence is necessary for efficiency. By careful and prolonged tests, the shooting efficiency of the men was

proved to be *30 percent worse* after the rumration than before it."

Alcohol and Liability to Disease.—Alcohol weakens the resisting power of the system and and thus indirectly renders its votaries an easy prey to attacks of diseases. The natural power of recovery is also much enfeebled; there is much delay in the healing of wounds in drunkards than among the sober people.

Prof. Metchnikoff has observed that "besides its deleterious influence on the nervous system and other important parts of our body, alcohol has a harmful action on the white blood-cells, the agents of natural defence against infection-microbes."

The investigations of Laitinen prove that "substances which should exist in the blood to complete the reaction by which 'resistance' is obtained are called '*complements*.' Small quantities of alcohol prevent the manufacture in the body or the storing up of such complements."

Alcohol and Accidents.—Accidents more often happen to drunkards than to sober persons. In the mill-districts in England, accidents are more frequent among topers than among the abstainers. Dr A. G. Miller, Surgeon to the Edinburgh Royal Infirmary, took statistics of accident cases admitted into the hospital on different days of the week. He found that the average number of accidents per day was 5.65, but on Saturdays, when wages were received and much drinking took place, the number of accidents rose to 10.26 or nearly double. This, however much to be regretted, is a matter of much less consequence than the disasters, often ending in great loss of life, caused by the unsteady nerves, defective perception and cloudy judgment of persons placed in the highly responsible posts of guards and drivers of our railways. How many such accidents, ending in broken limbs and appalling loss of life have occurred, due to indulgence in alcohol by such people while on duty! Much of this kind of accident may be prevented, if the railway authorities insist upon total abstinence as the principal condition of service of their guards and drivers.

Alcohol and Longivity.—The question of longivity in people who habitually indulge in drink has been a fruitful theme of discussion. It is true that some confirmed drunkards are seen to attain to old age, but a closer and more careful enquiry would go to show that in the case of the majority of drunkards, the life is shortened. The careful investigations of Life Insurance Companies unmistakably point to this fact, as no company would insure the life of even a moderate drinker at the same rate as in the case of an abstainer.

The "Poster."—I shall conclude my discourse on alcohol by quoting the admirable "Poster" on the "Effects of Alcohol on Naval and Military Work" issued by the most eminent Physicians and Surgeons of England, such as Sir Thomas Barlow, Sir Frederick Treves, Sur-

geon-General Evatt, Lt. Col. Woodhead and Sir Victor Horsley, men who are all total abstainers. I have taken this from the July (1915) issue of the "Calcutta's Young Men" :—

A TIMELY POSTER.

EFFECTS OF ALCOHOL

ON

Naval and Millitary Work.

TO ALL MEN SERVING THE EMPIRE.

It has been proved by the most careful

SCIENTIFIC EXPERIMENTS

and completely confirmed by actual experience in

ATHLETICS AND WAR

as attested by

Field-Marshal Lord Roberts, V. C., K. G., K. P.
Field-Marshal Lord Wolseley, K. P., G. C. B.
and many other Army Leaders that

ALCOHOL OR DRINK

(1) Slows the power to see signals ;
(2) Confuses prompt judgment ;
(3) Spoils accurate shooting ;
(4) Hastens fatigue ;
(5) Lessens resistance to disease and exposure ;
(6) Increases shock from wounds.

We, therefore, most strongly urge you for you own Health and Efficiency that, at least as long as the war lasts, you should become

TOTAL ABSTAINERS.

THOMAS BARLOW, M. D., F. R. S., K. C. V. O.
Pres. Coll. Phys. ; Physician to H. M. the King.
FREDERICK TREVES. F.R C.S., G.C.V.O., Hon.
Col. R.A.M.C., Sergeant-Surgeon to H. M. the King.
G. J. H. EVATT, M.D., C.B.
Surgeon-General, R. A. M. C.
VICTOR HORSLEY, F.R.C.S., F.R.S.,
Captain, R. A. M. C., T. F.
O. SIMS WOODHEAD. M. D., F. R. S.,
Lt. Col., R. A. M. C., T, F.

His Majesty the King-Emperor has set a most noble example by prohibiting the introduction of drink into the Royal House during the present war. Let us, Indians and Englishmen, as His Majesty's devoted and loyal subjects, follow his illustrious example and banish for ever from our homes and from our country this most dangerous enemy to human happiness and progress.

The time at my disposal will not allow me to dilate more fully on the subject. Those of you who wish to have a more detailed information will do well to read the excellent book on "Alcohol and the Human Body" by Sir Victor Horsley and Dr. Sturge and I assure you the perusal will amply repay the trouble. I have received much valuable help from this book in the preparation of this paper.

Opium.

The drug-habit for opium and some of its preparations is very extensively prevalent in all parts of India. There is a prevailing idea among common people in India that opium taken after 40 sustains life and removes some of the maladies of old age, and with this idea, many take to opium on the other side of 40. It is often begun as a medicine to check a tendency to diarrhœa or to allay pain in chronic rheumatic complaints and then the habit grows and it cannot be given up. Like alcohol, its dose has to be increased continually in order to get the

sensation of *well-being* that is experienced by opium-eaters after taking the daily dose, and it is surprising how large a quantity can be tolerated by a habitual opium-eater. 90 grains have been known to be the daily dose of some persons, the quantity being sufficient to kill 20 persons who are unused to the drug.

We quote the following lines from Chever's Medical Jurisprudence regarding the prevalence of the vice of opium-eating among certain classes of people in India :—

"The vice of opium-eating is a very ancient practice in India, specially among the Rajpoots. Todd frequently alludes to it in his *Rajasthan*. The date of the introduction of opium into India cannot be traced. The act of eating opium together was the form by which the rival clans became reconciled, and personal friendships were declared. *Umal lar Khana*"—to eat opium together—is the most inviolable pledge, and an agreement ratified by this ceremony is stronger adjuration. If a Rajput pays a visit, the first question is "*Umal Khya*" :—Have you had your opiate ?" "*Umal Khao*"—"take your opiate." On a birth day, when all the chiefs convene to congratulate their brother on another "knot to his years," the large cup is brought forth, and a lump of opium is put therein upon which water is poured, and by the aid of a stick a solution is made to which each helps his neighbour, not with a glass, but with the hollow of his hand held to mouth. A Rajput is fit for nothing without his *Umal* and Col. Todd often dismissed his men of business to refresh their intellects by a dose, for, when its effects are dissipating, they become mere logs. Opium, he adds, is more necessary to the Rajputs than his food."

Todd considered that the abuse of opium by the Rajpoots was comparatively recent, not dating back more than three centuries. In early times, they merely bruised the capsules and steeped them for a certain time in water, drinking the infusion which they called "*Tijarro*."

Dr. V. M. Bhatt of Baroda, who is now working in the Chemical Laboratory, Calcutta, had nearly 3 years' experience of conditions of life in Mewar, Rajputana, where he was the Medical officer during the years 1912-14. He informs me that the practice of offering opium to guests on all festive occasions, as described by Col. Todd, still prevails in Rajputana. Opium is made into a solution in water, put into the hollow of the hand of the host and the guest is made to drink it. Opium is sold very cheap in Rajputana, the price being only 5 annas *per tola*.

The practice of smoking "opium balls" (*Gooli*) is usually confined to low class people, but sometimes high class people are seen to indulge in this vicious habit. The balls are prepared of opium mixed with other ingredients, and at one time there were many licensed dens in this city where this vice was indulged in by groups of men belonging to the brother-hood. Opium-smoking is also very prevalent among the Chinese and the form of opium smoked by them is known as "*Chandu*." It is said that the Chinese have largely given up this vicious practice and I hope this information is correct. There is no drug-habit which demoralises and utterly undoes a man as opium-smoking. He suffers most in body as well as in mind.

The confirmed opium-smoker (*Goolikhore*) presents a most miserable picture of humanity.

"With an emaciated body often bent forward and a withered sallow countenance, a slow and halting gait, deep sunken eyes and perfectly indifferent attitude to surrounding things," he carries on a vegetating existence, "with disordered appetite, constipated bowels and an indomitable craving for his smoke at the appointed hour." They generally die early. Their moral sense is altogether lost; they are abject cowards; they studiously avoid quarrels and fights and would tell a lie under threat or for any consideration whatever. They swell the number of false witnesses in our Courts of Law.

Opium-eating, when kept within strict limits, does not appear to shorten life. But as Taylor says, there is sufficient evidence to prove that the practice gives rise to perjudicial effects on the system and tends to impair health.

Opium-eating begun early in life generally affects the health by impairing the functions of the internal organs and leads to impaired growth, early decay and premature death. It is often observed that old people tolerate opium better and in their case, if the dose is kept within strict limits, it does not appear to exercise much deleterious influence on the health of the person, but it cannot be denied that it affects his active habits and dulls his intellect.

The chief active principle of opium is morphine which possesses much of the medicinal and poisonous properties of the drug. Like

opium, it is a valuable medicine in the hands of the physician, and like the parent drug, it is also extensively abused. The morphine-habit is much more prevalent in European countries than in India where opium is more easily obtained and is much less costly.

Dixon Mann, in his book on Forensic Medicine, thus writes of the morphine-habit:—

"The habitual use of morphine produces a most debasing effect on moral character. You will rarely find a man addicted to opium-habit voluntarily cease taking the drug; his craving for it is such that nothing short of physical hinderance will restrain him. Under the sway of this habit, men and even women of refined character will resort to the meanest artifices to gratify it. If the habit is of long continuance, the memory becomes impaired; this at first seems to me the result of inattention; the patient is absent-minded and does not give himself the trouble of focussing his thoughts upon the subject under consideration. At this period, if sufficient mental stimulus is brought to bear, he is capable of concealing his weakness by increased mental effort; subsequently, there is an actual loss of memory which can not be overcome. In this stage, hallucinations are common and may give rise to delusions like those of chronic alcoholic insanity. The habit is exceedingly difficult to eradicate, but if eradicated, recovery is more complete than in the analogous condition produced by chronic alcoholism, because of the absence of vascular and other degenerative changes which accompany the latter, and which, of course, are permanent. If mental enfeeblement through opium-eating is pleaded as a bar to criminal responsibility, it is to be regarded much in the same light as the plea of chronic alcoholism."

Opium is verly largely used as a suicidal poison in India. In toxic doses, it produces "heaviness of head, incapacity for exertion, giddiness, drowsiness, a strong tendency to sleep ultimately passing into perfect insensibility, the person lying motionless with the eyes closed

as if in a sound sleep. He may be roused by a loud noise, but speedily relapses into stupor." Slow noisy breathing and a slow full pulse followed by a rapid small pulse supervene; the pupils in the early stage are contracted and insensible to light, but later on as the case progresses to fatal termination, they become dilated. Ultimately, death takes place by stoppage of respiration. Children often suffer from convulsions but this symptom is rare in the adults.

Cocaine.

As regards cocaine-habit, I would repeat what I said in 1911, that not many years ago, cocaine was a drug hardly known to the people of India outside the medical profession, and now, sad to reflect, it has taken a vigorous hold of a certain class of people in this country, both in towns and in villages. In Calcutta, despite the vigilance of the Excise Authorities and notwithstanding the stringent measures directed by Government against the possession and sale of this substance by unlicensed persons, there is reason to believe that the cocaine-habit has much increased and is rapidly increasing. Cocaine used to come from Germany and Austria; the war with Germany, in spite of its many evils, has done good to India by stopping the importation of cocaine and thus saving thousands of people from its evil influence and disastrous effects.

Owing to the dearth of cocaine-supply, cocaine-dealers have now resorted to the deceitful practice of selling substances other than cocaine, such as boric acid, benzoic acid, antifebrin, bicarbonate of soda, sugar, flour etc., etc., as cocaine, and it is amusing to note how the victims to the cocaine-habit complacently use the spurious substance believing it to be cocaine.

Considered sociologically, it is perhaps safe to say that a considerable portion of the crimes committed in Calcutta may be traced to the utter moral depravity which follows the habitual use of cocaine. The daily papers are full of the reports of raids on cocaine-dens and of cocaine-seizures, and the references made to the Chemical Examiner in connection with the illicit import and the unlawful possession of cocaine are rapidly and progressively on the increase, as will be seen from the figures given below compiled from the Annual Reports of the Chemical Examiner's Department, Bengal, for the last seven years.

Year.	Number of samples of cocaine seized and sent for examination.
1908	125
1909	243
1910	621
1911	2138
1912	1661
1913	4875
1914	4330

Although the cocaine-habit has been described by Erlenmeyer as the third scourge of humanity, the two first being alcohol and opium, yet in some respects, cocamania is more disastrous in its effect on the moral, intellectual and the physical well-being of the subject. Apropos of this, Prof. Berkley of the John-Hopkins University has observed that he could trust a cocaine-debauchee even less than he would a morphino-maniac, stating as his reasoh that the moral rectitude and the will-power of a cocaine-eater always suffer more seriously.

Taylor in his Principles and Practice of Medical Jurisprudence, referring to cocaine-eaters, states that "like morphia, the habit of cocaine seems to sap the moral fibre of its devotees, so that they become reckless of everything in their efforts to obtain their dose; lying, cheating, stealing—nothing comes amiss to them so that their craving is satisfied."

Dr. A. H. Brundage, Professor of Toxicology in the Brooklyn College of Pharmacy, remarks that the cocaine-habit "is the most seductive, dangerous, and mentally, physically and morally destructive of all the drug-habits. Cocaine fascinates by the promptness with which it relieves all sense of exhaustion, dispels gloom and exhilerates, producing a sense of happiness and well-being—which transports at once to a longed-for elysium. Primarily, the after-effects are scarcely perceptible, but through continual indulgence, an intense craving for the drug or its effects is produced."

"It is the utter banishment of gloom and the delightful sense of *bien-etre*, which together are directly responsible for the intense craving characteristic of the habit and productions of physical, mental and moral degradation and depravity which ensue."

Prof. Berkley reports that the body-weight sinks rapidly, even 1/5 to 1/3 of it being lost within a few weeks.

Prolonged use of cocaine causes sleeplessness, nervousness, nervous and muscular irritability, illusions of sight and hearing, dyspepsia, insensibility to pain, disinclination to work, avoidance of friends and society, mistrust, moral perversion, rapid emaciation, blackening of the teeth, muscular weakness and tremor, fainting fits, irregular action of the heart, and sometimes collapse and death. I have dealt with several cases, in my capacity as Chemical Examiner, of sudden death following the habitual use of cocaine.

A case is on record in which ½ grain of cocaine taken internally caused death. Cocaine acts very rapidly and its action passes off also very rapidly. Death has occurred in 40 seconds.

In small doses, it excites the brain and the spinal cord; in large ones, it may produce convulsions and then paralysis. It paralyses the endings of nerves distributed on the surface; the sensation is, therefore, temporarily lost.

This anæsthetic virtue of the drug is utilised in making small surgical operations.

Indian Hemp.

Indian hemp is used in this country in various forms as an intoxicant. The leaves, called *Bhang*, are made into a paste and then mixed with sugar and water and drunk as *sherbet*. The flowering tops, called *Ganja*, as well as the resin which exudes from them called *charas*, are smoked like tobacco, when they produce the desired effect. A kind of sweetmeat, called *majoom*, is also made from the leaves by mixing the pounded leaves with milk, spices and sugar, baking the mixture and making it into small rectangular cakes.

The drug is also known as *Hashish*, and the word assasin is derived from *Haschischi*, meaning the followers of the "Old man of the mountains" who used to commit murders under the influence of this drug.

This drug is very largely used by low class people for its intoxicating properties. The leaves are also used by a certain class of criminals to produce insensibility in the victims in order to facilitate theft or commit sexual crimes; they are also used as aphrodisiac. The chief effect of the drug is on the brain and nervous system producing, first, excitement followed by insensibility if the dose is large. The excitement is characterised by hallucinations,

often of a pleasurable and sexual character. The man laughs, sings, cries or tallks without control. Those that are addicted to the habit assert that all worries and anxieties of life for the time being are forgotten, and they enjoy a blissful state of existence which they cannot get from any thing else. The smoking of *ganja* affects the temper, making it easily excitable and rough, and those that indulge in it could easily be led to commit acts of violence on the slightest provocation.

The appearance of a confirmed *ganja-smoker* is characteristic. He is thin, ricketty and "dry," his eyes are sunken, his cheeks flattened and he has a faded look. If the victim at the same time gets good fatty food, the thinness of the body may be prevented to some extent. He becomes very irritable and excitable, and very rough in his manners and speech. The speech in certain cases may be lost for weeks, but not the voice.

The homicidal mania known as "*running amok*" in which a man kills a number of persons, often without any motive, has been traced in many cases to the excessive indulgence in *ganja-smoking*, although other intoxicating drugs have been responsible for such crimes.

The stage of excitement is followed by insensibility (if the dose is large) and may sometimes end in death.

The prolonged use of this drug, specially when smoked, leads to permanent disorganisation of the brain, producing insanity. The statistics of the lunatic asylums in India point unmistakably to Indian hemp as a potent factor in the causation of insanity in India. In 1907, out of 5474 insanes in Indian asylums, in 602 cases, the insanity was ascribed to hemp drugs, in 135 to alcohol, and in only 31 to opium.

Major G. F. W. Ewens reports that "indulgence in hemp drugs is responsible for the greater number of cases of mania admitted into the Punjab Asylum. Of 543 such cases admitted in the triennium (1900-1903), in 161, their causation could be reasonably assigned to the hemp habit. This proportion is very high, and is higher than in the lower provinces. For example, in Berhampore (Bengal), of 332 cases of mania, in only 56 can indulgence in Indian hemp be attributed as the cause. The reason of this, however, in all probability, lies in the fact that whereas in the Punjab, the more potent resin, *charas*, is the preparation used, in Bengal it is *ganja*, a much mider drug. With an experience of both provinces, I can further state that the toxic mania due to *charas* indulgence is much greater in degree to that seen after indulgence is *ganja*. Both are, however, exactly similar in type," *Lyon's Medical Jurisprudence.*

It is not always that the prolonged use of the drug causes insanity. Sometimes we find

a temporary mania results from a single indulgence in the drug. Continued indulgence often leads to acute mania of a noisy character which gradually passes into a state of partial mania.

"In Europe, alcohol is the most potent factor in the causation of insanity. In India, spirit-drinking is much less common, and consequently there are more cases of insanity due to indulgence in Indian hemp than in alcohol."—*Lyon's Medical Jurisprudence.*

The sudden discontinuance of *ganja* smoking, according to the experience of many medical men, is not followed with serious results as in the case of opium-eating. It no doubt causes great suffering to the victim for the time being, but then it passes off without untoward results.

Tobacco.

Tobacco is so extensively used for smoking that few people would believe that it possesses highly toxic properties. Yet its active principle, called *nicotine*, is a deadly poison. $\frac{1}{10}$ part of a drop of *nicotine*, when directly introduced into the system, is sufficient to kill a man not accustomed to its use within a few minutes. Fortunately, when tobacco is smoked, the greater portion of *nicotine* gets burnt and decomposed, and thus only a little of it could get access into the system and exert its toxic action. Cases are on record in which serious symptoms follow-

ed the application of tobacco leaves on the surface of the body for relief of pain, and of death following the swallowing of the leaves, the use of the infusion of the leaves as an enema, and even swallowing the thick liquid which collects in the tobacco-pipes during smoking. Death is reported to have also occurred in a novice after smoking two pipes, and after continuous smoking of 17 or 18 pipes in habitual smokers.

Some idea of the enormous quantity of tobacco consumed annually may be formed from the figures available for the United Kingdom:—"About 70,000,000 (seventy millions) pounds of tobacco are smoked annually in the British Isles, of which 38,000,000 (thirty-eight millions) are said to be reduced to ashes in pipes, 5,000,000 (five millions) in cigars, and the remainder (twenty-seven millions pound) in cigarettes. The cigarettes alone at 2s. 6d. per 100 would cost £ 12,000,000,00 (twelve hundred millions sterling)."—Banks.

Tobacco has a paralysing action on the heart. It also paralyses the spinal cord destroying motion, and it kills by paralysing the respiratory centre. To one not accustomed to smoking, the first smoke causes giddiness, faintness, depression, muscular weakness, nausea, vomiting, and weak, quick and irregular pulse. People gradually get accustomed to its action and get a tolerance of its poisonous effects.

Tobacco smoke irritates the throat and the organs of respiration. Smokers often suffer from a hacking cough caused by a kind of sore-throat known as the "smokers' sore-throat." Particles of smoke deposit in the lungs and form black-coloured patches there. These debilitated spots may, under favourable circumstances, form the foci for tubercular infection. It has been stated on good authority that constant irritation from tobacco-smoke has produced cancer in the throat and in other parts of the respiratory passages.

A kind of blindness, *tobacco amaurosis*, is known to have followed heavy smoking. It has also been known to produce a kind of paralysis.

Smoking begun too early in life causes physical deterioration. Young men, therefore, should never indulge in this pernicious habit. One of the recommendations of the Inter-Departmental Committee on Physical Deterioration in England was "to prohibit the sale of tobacco and cigarettes to children, and also the prohibition of the sale of cigarettes in sweet-shops and other shops frequented by children." Japan is ahead of England in this respect, as smoking by youths under 20 has been suppressed by law in Japan. I am glad to be informed that the Government of the United Provincess, and the Director of Public Instruction, Bihar and Orissa, have taken preventive measures against

smoking by school-boys. I wish some such official measure should come into force in Bengal.*

I express my thankfulness to Lt. Col. Sir Leonard Rogers, C.I.E., F.R.S., M.D., F.R.C.S., F.R.C.P., I.M.S., and to Dewan Bahadur Prof. H. L. Basu F.R.F.P.S. (Glasgow), M.R.A.S. (Lond.), for kindly lending me some models, specimens and diagrams for illustrating my lecture.

* An Act has since been passed in Bengal making smoking by boys under 16 penal :—*EDITOR.*

Temperance Movement in India.*

My first duty is to thank you for the great honour you have done me by electing me to be the President of the "All-India Temperance Conference" at its 14th annual session.

None feels more keenly than I do the small claim I have, of all persons assembled in this place, to take up this high office, and I approach with great trepidation of heart the responsibility of the Chair which has been graced in former years by most distinguished and veteran workers, European and Indian, in the noble cause of Temperance. But the thought which gives me courage is that those kind friends to whose indulgence I owe this high honour will guide me in the discharge of my responsible duties as the President of the Conference, and I invoke the blessing of God and the good wishes of my predecessors in office to help forward successfully the blessed work which it has pleased God to place in our hands.

* Presidential address delivered at the fourteenth annual session of the All India Temperance Conference held at Calcutta on the 27th and 28th December, 1917.

My next duty is to thank my own Government for kindly according me permission to preside over the deliberations of this annual gathering of Temperance workers. The cause of Temperance lies deep in my heart, and although I cannot claim any special achievement in the field of Temperance work, I have, from the early years of my life, lent to this movement my whole-hearted support and have always, by profession and practice, upheld its noble cause. I, therfore, felt deeply grateful to my Government when I obtained their permission not only to take part, but a very prominent part, in the proceedings of this " All-India Temperance Conference."

In this connection, I am sure I voice the unanimous sentiment of this distinguished assembly that it is a matter for sincere congratulation that we have Mr. W. R. Gourlay C.I.E., I.C.S,, as the Chairman of the Reception Committee this year. Mr. Gourlay is a distinguished member of the Indian Civil Service and a most trusted officer of Government. His long service in this province, particularly as Private Secretary to two successive Governors of Bengal, has brought him into close contact with all classes of people. He holds a high place in the confidence, affection and esteem of the people of Bengal, and the active co-operation of such a distinguished person who is alike in the confidence of the Government and the people should greatly advance the cause of

Temperance in this province, and will be helpful in removing many ill-founded prejudices and wrong impressions entertained in respect of the Excise policy of Government. The cause of Temperance in India feels grateful to the Government of Bengal for kindly permitting some of its officers thus to participate actively in the Temperance reform movement.

GOVERNMENT AND TEMPERANCE REFORM.

This action of Government, I submit, points to something else. It throws light on its attitude towards this important movement, and, to my mind, is not inconsistent with its professions in regard to its Excise policy and administration, made public from time to time in its various communications and despatches bearing on the subject. There is no department of Government whose work is looked upon with greater distrust and disapproval by the general public than the Excise Department, and the charge often levelled against Government is that it trades on liquor and drugs, and its officers indirectly help the spread of the vice of drinking for the purpose ot increasing Government revenue. It cannot be denied that this impression has got a strong hold on the popular mind and cannot be easily eradicated. But this charge, I am glad to say, cannot be substantiated by trustworthy evidence. If one goes beneath the surface, he will see that the Excise policy of Government

has always been friendly to the cause of Temperance. He will further find that Government has, from time to time, promulgated various measures calculated to encourage and foster a habit of temperance in the people, to check the growth of intemperance and to minimize the evils of the liquor traffic. Indeed, Government has at times declared in favour of total abstinence and has deprecated in most unequivocal terms the idea of increasing its revenue by the sale of liquor. I ask your permission to place before you a few extracts from Government records bearing on the Excise problem which will leave no doubt in your mind that the declared policy of Government relating to the sale of liquors and intoxicating drugs is most friendly to the cause of Temperance.

(i) The Secretary of State for India, in his despatch, dated March 14, 1889, said: "The taxation of the sale of intoxicating liquors is imposed primarily to restrain the consumption of such liquors and not for the purpose of making money out of their sale."

(ii) The Government of India, in a letter to the Government of Bombay, dated 21st April, 1904, said: "The subject is one which the Government of India regard as of vital importance to the welfare of the community, and it cannot be too strongly impressed on the administrative officers that the Government policy is to discourage drinking and to do all that is possible, without undue interference with the liberty of

the subject, to suppress the degrading and demoralizing habit of intoxication."

(iii) "Their (the Government of India's) settled policy is to minimize temptation to those who do not drink, and to discourage excess among those who do."

(iv) "It should be made clear that the Government is on the side of abstinence."

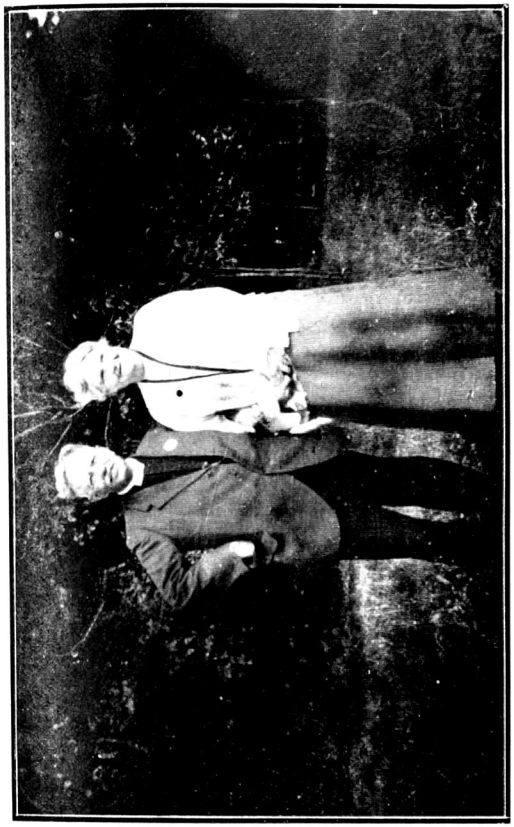
(v) "Fiscal considerations in connection with the liquor traffic are important, not as an end in themselves, but simply because the most effective method of forwarding the policy of Government in regard to consumption is to make the tax upon liquor as high as it is possible to raise it, without stimulating illicit productions to a degree which would increase, instead of diminishing, the total consumption, and without driving people to substitute deleterious drugs for alcohol or a more or less harmful form of liquor."

(vi) "The Collector is responsible as Magistrate for the peace and sobriety of his district: this is his primary duty; the revenue interests of Government, important as they are, must come and do come after it." *Lord Hardinge in reply to Temperance Deputation in December*, 1913.

(vii) "The Government of India, the Local Governments and Administrations and their officials are unanimous with you in desiring to promote the cause of Temperance in this country by all means in their power." *Ibid.*

Now, gentlemen, I could multiply many more such references which clearly represent the Government view of the subject and the policy it has firmly set before it in dealing with the traffic in liquor and drugs.

There is, therefore, little justification for levelling the aspersion above-mentioned against Government. There may be instances where we find from the reports that the settled policy of Government in regard to liquor and drug traffic is not always acted up to in its true spirit; but such cases should not be accepted as evidence of the intention of Government to depart from its declared policy. I am glad that only three years ago, the Rev. Herbert Anderson who presided at the 12th "All India Temperance Conference" at Madras, declared from this chair that "the suggestion that officers of Government have pushed the sale of liquor and drugs for revenue purposes at the expense of the welfare of the people, is not true." He further observed that "Government had vindicated its position; it had proved, and he thought satisfactorily that taking the country as a whole, the consumption of intoxicating liquor had not increased alarmingly, and that administrative control was anxious to check any immoderate increase of consumption of either liquor or drugs." I know of no other non-official gentleman who possesses a greater knowledge and experience of the details of work of the Excise Department than my esteemed friend Mr.



Rev. Herbert and Mrs. Anderson

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Anderson, and this testimony coming from him carries a very great weight.

I do not pretend to say that Government is not interested in the revenue it obtains from its Excise administration. On the contrary, I maintain that as it is an important source of revenue, Government is bound to attach to it due importance. But what I wish to emphasize here is that this fiscal consideration is subordinated by Government to a higher moral consideration, namely, the protection of its subjects from the degrading and demoralizing vice of drunkenness. And if it ever happens that the people of India are prepared to give up altogether the use of liquor, I verily believe that our Government will be the first to sacrifice its Excise revenue at the altar of a higher cause, *viz.* the moral regeneration of the people. If half-civilized Russia and backward China could forego their enormous income from the sale of *Vodka* and *Opium* respectively, how much more could we expect our civilized, humane and most resourceful British Government to do when the right time comes.

Although there is considerable difference in some of the principles set forth by Temperance organizations in India and those underlying the Excise policy of Government, it is not of such a character as to make the relation between Government and Temperance workers anything but cordial and helpful to each other.

I agree with the statement of my distinguished brother Sir Bhala Chandra Krishna, Kt., of Bombay, who, when President of this Conference in 1905, said : " Our position, therefore, is no longer one of opposition but of co-operation. We have no desire to embarrass the Government, and do not approach the subject in a spirit of fault-finding. Our only object is to help Government in the detection and correction of abuses. We recognise that the present attitude of the Government is in consonance with the objects of temperance, and when we find that any measures of Government are not in conformity with their declared attitude, we endeavour to obtain their correction. In doing so, we really help Government to make their measures conform to their own declared policy."

THE TEMPERANCE IDEAL IS PROHIBITION

Let me now, however, emphasize what I regard as the main difference between the policy of Government and the position to which Temperance workers, have been led, partly by the march of events throughout the civilized world, partly by the change in the medical verdict upon the use of alcohol or drugs in small quantities and partly by the traditions and social and religious sentiments* of the Indian nation. The

* The Hindu Law-givers interdict the use of alcohol in any form by the higher castes :—

मद्यमपेयमदेयमग्राह्यम् (उशनः संहिता) ।

Government bases its policy upon what it terms a legitimate demand, and in favouring temperance, only restrains the consumption of liquor where the results point to excess. It is only prepared to *minimize* temptation, and only *discourages excess*. Now, I hold that Temperance workers all over the world have come to an unanimous conviction that the only wise ideal is

" *Madya* (wine, even of the superior kind) should not be drunk by anybody, or given to anybody, or accepted by anybody."

सुरां पीत्वा द्विजोमोहादग्निवर्णां सुरां पिबेत् ।
तया स्वकाये निर्दग्धे मुच्यते किल्बिषात्ततः ॥
गोमूत्रमग्निवर्णं वा पिबेदुदकमेव वा ।
पयोघृतं वाम्मरणाद् गोशकृद्रसमेव वा ॥ (मनुसंहिता)

" A twice-born man who has (intentionally) drunk, through delusion of mind (the spirituous liquor called *Sura*) shall drink (by way of expiation) that liquor boiling hot ; when his body has been completely scalded by that, he is freed from his guilt. Or he may drink cow's urine, water, milk, clarified butter or liquid cowdung boiling hot until he dies."

सुरापाने ब्राह्मणोरूप्यतास्रसीसकानामन्यतममग्निकल्प पीत्वा शरीरत्यागात् पूयते । (देवलस्मृति)

" In the case of drinking (the spirituous liquor called *Sura*), a Brahmin is purified by death by drinking fire-coloured (liquefied) silver, copper or lead. "

The Buddhistic Scriptures strongly condemn the use of intoxicating liquors and drugs by the followers of the creed.

Of the *pancha-sila*, which is incumbent on all professing the religion of Buddha, the fifth one prohibits the use of drinks and drugs altogether. It runs as follows :—

" Sura meraya maija pamadathana veramani sikkhapadam samadiyami. "

" The use of all sorts of intoxicating or spirituous liquors or drugs is the road to death. I accept this instruction. "

prohibition of both the manufacture and the vend of drink, except for medical and economic purposes. Our goal in India is that which the United States in America and Canada have both almost reached—*a constitutional nation-wide prohibition of the drink-traffic.* Our duty now is to try and win the Government to our way of thinking, and by all constitutional means, to get both the Government and the people of India to rid themselves of the notion that there is a legitimate demand for liquor as a beverage, which it is the duty and, therefore, a part of the policy of Government to supply.

There can be no question that the traffic in liquor is a great evil, and if I could, I would not wait until to-morrow to banish all liquor production and sale, for ordinary drinking purposes, from India. But it must be conceded that it is an evil which cannot be done away with altogether by a stroke of the pen. It, therefore, behoves us, as men of sound common sense, to see that its growth is curtailed and the attendant evils everywhere largely minimized. And here, Gentlemen, the Government and the

In the Singalovad sutta of the Diggha-Nikaya, the habit of drinking is mentioned to be Roganam Ayatonam—the cause or seat of all diseases. In other places, it is charectesized *Sandhithika dhona yani*—causes destruction of wealth ; Akitti sanjanani—brings unpopularity; Panna dubbalakarani—produces madness, etc.

In the Noble Eight-fold path (अष्टाङ्गमार्ग), in the classification under head Sama Ajiva **समा आजीव**, the manufacture as well as sale of all kinds of drinks and drugs have been strongly condemned.

Temperance workers stand on a common platform. The attitude of all Temperance organizations in India towards Government should, therefore, be one of confidence and co-operation, and I would appeal to Government with all the earnestness I can command, that this desire to co-operate should be reciprocated to the fullest extent by them.

PRESENT CONDITION IN INDIA.

Passing on from the subject of policy to that of the present condition of India in regard to the drinking habit, I cannot speak with accurate information upon the other provinces of India. But if Bengal, may be taken in any way as a representative area, I should, upon the basis of our conditions in this province, say that the educated classes are very much less addicted to the evil habit of intemperance than they were half a century ago, while conditions are very much worse and are growing seriously so among the working classes and especially in the labour centres of the land.

The Educated Classes.—There was a time, in my province at least, when people were dazed by the first flood of the light of English education. Drinking was then considered to be a proof of enlightement, culture and moral courage by young Bengal, and the educated classes began to drink as much brandy and as much poetry of Shakespeare and Milton as they could swallow. The vice was most predominant in the legal and medical professions. It was the

efforts of the late Prof. Peary Charan Sircar and Kesub Chander Sen and his New Creed that helped to put an effective check on the vice of drunkenness in Bengal. Happily, that infatuation for drink has largely disappeared from the educated Bengali society of to-day, and close observation for the last forty years enables me to say that the vice of drinking has not now many victims among the literate classes of Bengal, except perhaps in the case of a small community which has adopted the English mode of living and in which the prejudice against drink is not as strong as it ought to be. It is also a matter for congratulation that this vice is seldom indulged in by the student community of this province. It was not so in my student days. In our class of 20 in the Calcutta Medical College, I had positive knowledge of no less than three of my classmates addicted to drink. At the present time, it will be difficult to find even one student among the 800 in the Calcutta Medical College showing partiality for the vice. If it is true in the case of the students of the Medical College, it applies with greater force to the students of the Art colleges. Indeed, the large body of Bengali students of the present age is singularly free from this degrading vice.

The Working Classes.—But if the educated classes in Bengal have reformed, the same cannot be said in respect of the working classes. It has been our sad and bitter experience to see

the habit of intemperance growing rapidly among the working population. The real cultivators of the soil, except perhaps among the aboriginal tribes, are generally sober. It is the men who work in mills and factories who swell the number of drunkards among the lower classes and suffer most physically, morally and economically for their folly.

Pay-day of the week is the worst day for people living in the neighbour-hood of all mills and factories. They are subjected to all sorts of annoyances and indignities by the drunken workmen who spend almost every pice they earn during the week in the grog-shop and leave their poor families to starvation and destitution.

Gentlemen, we and Government have a most important duty to perform in connection with the labourers at mills and factories all over India.

A start has been made in this connection in Bengal. I sincerely hope that it will be successful. It is to the interest of the mill-owners themselves that they should get sober workmen. I, therefore, earnestly appeal to them, in Bengal as well as in other provinces of India, to help us in our efforts to check the vice of drunkenness among their own workmen. In the second Resolution, you will be asked to approve a special appeal made to Government upon this point. The wasting power of alcohol is enormous, and the working

efficiency of our labouring classes will be seriously weakened unless something is done and done soon.

TEMPERANCE AND THE CO-OPERATIVE MOVEMENT.

In connection with this increase of the drink-habit among the labouring classes, we have to remember the most laudable attempt now being made throughout the Empire for the encouragement of thrift through the Co-operative movement.

This movement is getting a good hold in many parts of the country. Its growth is necessarily slow where the majority of the people are very backward in education and are, therefore, incapable of quickly recognizing the benefits of the system. Although it is an institution of recent growth, its progress appears to be steady and satisfactory, and the annual return of work of a larger number of Societies distributed all over the province, shows that the people generally have begun to appreciate its advantages. It is not remarkable that the one great precaution that is taken in the organization of these Societies is to exclude as far as possible men addicted to drink from the list of members, as "drink, gambling and other forms of loose morals and social indiscipline have necessarily to be sternly discouraged where a community of men stand jointly responsible for the debts

of one another." Now, as the Co-operative movement grows and members are drawn from the working classes, it is very important that the growth of intemperance should be reduced among them as much as possible in order that the work of these societies may be put on a still more satisfactory basis. This question is intimately connected with the economic development of the country, and it is incumbent on all to see that these people are kept away from the temptation of drink. May we not appeal to Government, in the interests of that character necessary for the success of Co-operative Banks and other Societies, to take away all temptation to drink from areas where the Co-operative movement is gaining ground. I hope all interested in Co-operative Societies will make this appeal.

TEMPERANCE AND THE MEDICAL VERDICT.

As a medical man, I take my firm stand on the principle of Total Abstinence. Whatever might have been the opinion of the medical profession, a quarter of a century ago, on the effects of alcohol on the human system in moderate doses, its verdict is unanimous to-day that it is not only not needed in health but that its continued use, even in small doses, affects prejudicially the structures and functions of the different organs of the body. The best physicians and the best surgeons of the day, both in

Europe and in India, uncompromisingly subscribe to this view, and in support of my statement, I would refer to the "Poster" issued to the Allied Army in 1915 by doctors in England who are the recognized heads of their profession, and whose experience and knowledge render their statements above all criticism and doubt. Among them were the late Sir Victor Horsley, the greatest Brain-surgeon of his day, Sir Frederick Treves, one of the greatest living surgeons, Sir Thomas Barlow, Physician to His Majesty the King, and other distinguished medical men who are in charge of some of the largest hospitals in England. They most strongly urge that for the health and efficiency of the combatants, they should at least, as long as the War lasts, become total abstainers.

And coming nearer home and to a more recent date, I would refer to a statement which, I believe, is ready for circulation, and which has been signed by the most eminent physicians and surgeons practising in Britain and India, urging upon the people to give up the use of alcohol and other intoxicating drugs in view of their deleterious effects on the system.

Gentlemen, in a matter like this, we must be guided by the opinion of men who, from their knowledge of the human body, of the changes produced therein by alcohol, and from their large experience in the treatment of diseases caused by drink, are the best persons to speak authoritatively on the subject. Medical opinion

in England is strong against the use of alcohol even in cold climates; how much stronger does the argument hold against its use in a tropical country like India! Lt.-Col. Sir Leonard Rogers, Kt., F.R.S., of the Indian Medical Service, the present recognized authority on tropical diseases, has strongly condemned the use of alcohol in this country from every known fact of hygiene and scientific observation. It is the root-cause of a number of serious diseases by effecting changes in the blood and blood-vessels and generally depressing the natural resisting power of the body. In malaria, the greatest scourge of India, alcohol plays a most important part in lowering the resisting power of the body and specially, the defensive power of the blood against the potent parasite. Now, malaria is most prevalent among the poor people, and it is among them unfortnnately that the habit of drinking is also rapidly growing. This is a matter for serious consideration both to Government and to the leaders of the community. Cholera is another fell disease which claims thousands of victims annually in India, and it has been found by experience that intemperate people succumb most easily to this disease. Apoplexy, epilepsy, paralysis and sunstroke claim more victims from among drunkards than from among sober people. Duncan has shown by facts and figures that sunstroke is unknown in a teetotal army serving in a tropical country. The use of alcohol by British

troops in India predisposes them to attacks of sunstroke, pneumonia, typhoid fever, dysentery and cholera. Experienced surgeons serving with the British army in India have all along raised a warning note against the issue of rum-rations to the army. The exciting causes of liver-abscess and many other serious tropical diseases have also been traced to drink. Insanity is another terrible disease the incidence of which in a community is directly proportional to the prevalence of the drink and drug habit therein. In England and other European countries, drink is accountable for the largest percentage of admission into lunatic asylums. *Ganja* and *charas* have hitherto been responsible for most cases of insanity in our asylums in India, but it is to be feared that a heavy toll will soon be claimed by alcohol also.

Then again, alcohol not only injures the consumer, but its baneful effects are often carried down to posterity. Dr. Clifford Allbutt says that drunkenness is distinctly hereditary. Prof. Adami in his address on the "Study of Eugenics" says that it has been long observed that intoxicants affecting the body of the parent are liable also to affect the germ-cells. Prof. Clifton Edgar in his "Practice of Obstetrics" observes that alcohol in the fœtal circulation tends to arrest the highest development. Mothers addicted to drink should take a timely warning from this.

I need not take up any further time in dealing with the medical aspect of the drink-question. What I wish to emphasise here is that long-continued use of alcohol in moderate doses undoubtedly produces pathological changes in the body, particularly in the nervous system. These changes may not immediately affect the conduct and action of the individual in the performance of the ordinary duties of life, or may not even prevent him from attaining to the average limit of human life. But a closer and careful examination reveals the fact that prolonged imbibition of alcohol, even in small doses, dulls the natural sensibility of the nervous system, affects the temper, and destroys the fineness of thought, reason and judgment.

TEMPERANCE AND THE WAR.

The common saying that even the darkest cloud has its silver lining, has its special application in the case of the present terrible European War. Although it is causing the greatest amount of sorrow, misery and desolation in the homes of all nations engaged in it, it has done one good, viz., it has fostered the habit of temperance among them and has been helpful in solving many difficult war and industrial problems. Russia has totally abolished her trade on "Vodka" and her old Government had decreed that public drunkenness should be punishable with 18 months' imprisonment, and violence and robbery by drunkenness with 6 to 8 years'

penal servitude. The effect of these measures, in the words of General Alexis Polivanov, has been that (1) the efficiency of labour has increased,(2)drunkards and beggars have disappeared, (3) profane language is scarcely heard, (4) men's treatment of women and children has improved, and (5) the women are happy and and pray God that the sale of liquor may never again be permitted. In the words of an Englishman, Mr. Hamilton Fyffe, Petrograd correspondent of the London "Daily Mail,"—"the prohibition argument is strong, crime has become rare, Savings Bank deposits have increased enormously. The number of patients in Petrograd hospitals has fallen off in a surprising degree. Peasants, who, in "vodka" days, never put by a "kopek" are buying good ploughs and drills and harvesting machines." Another Englishman, Mr. Samuel G. Blythe, the Russian correspondent of the "Saturday Evening Post," writing on the condition of Russia after prohibition, says that "Russia at War—as Russia is—is a far stronger Russia, a far more prosperous Russia, a far more lovable Russia, a far more civilized Russia than before the war began and before the prohibition of "vodka." Prof. Simpson of Edinburgh has collected statistics which show that during the first three months of the prohibition of "vodka," there was a diminution of 47 per cent in the number of fires and of 56 per cent in the value of property destroyed.

The deposits in the Savings Banks in Russia were £1,80,000 in 1914, which was the year in which prohibition was introduced; it amounted to £5,600,000 in 1915, and £12,000,000 in 1916. The national prosperity increased *pari passu* with decrease in the consumption of liquor. All this had taken place before the present distressing situation in Russia was created, and the future of that unhappy country now lies in the lap of the gods. It would, however, appear from a recent telegram that the present would-be rulers are prepared to follow the Czar in the determination to dethrone alcohol among the populace. Under their instructions, all spirits and wines in the vaults of the Winter Palace in Moscow and elsewhere were destroyed.

The Government of France has taken drastic action by prohibiting the importation of spirit into that country and Algeria; they have also commandeered the whole of the national production of spirit for industrial purposes. It is further reported that "in France and Norway, the manufacture and sale of all spirits are now prohibited, and the manufacture of other intoxicants has also been greatly reduced to prevent the waste of the much-needed food-stuffs."

In the United States, the House of Representatives has adopted the Postal Bill prohibiting the shipment of any kind of intoxicating liquors into what are called "prohibition states." Of the 2,543 counties in the whole of the 48 states of the United States, 2,188 had voted out

the liquor traffic at the last election and only 355 counties were under license. The Congress of the United States has passed a measure prohibiting the use of the United States mails for conveyance into "prohibition states" of any kind of liquor advertisements, either in newspapers, by circular or other methods.

Ontario has enjoyed the full privilege of prohibition since September 1916, and the moral cleansing which its chief town Toronto has undergone may be seen from the fact that while in 1915, from September to October, there were 1,059 arrests for disorderly conduct resulting from drunkenness, that numbsr has decreased to 214 only in 1916.

Absolute prohibition has been introduced in Newfoundland from 1st January, 1917.

The Government of Denmark, after prohibiting the use of Danish corn and potatoes in the manufacture of alcoholic liquors, have now prohibited the manufacture of all intoxicants throughout the whole country in order to preserve the food of the people.

The question of prohibition is strongly agitating the minds of the people of the United Kingdom. Only the other day, a very strong deputation consisting of some members of Parliament and some eminent clergymen waited upon thePrime Minister of England askingthe Government for prohibition during the War and demobilization.

The citizens of Edinburgh have appealed to the City Council to petition Government for the suspension of the liquor traffic during the War, basing their convictions on the following facts:—

(1) That the drink-traffic dissipates the nation's strength at the moment when it should be at its maximum.

(2) That the drink traffic materially reduces our food supply. In two years of war, it has consumed over 30,00,000 tons of food-stuffs and sufficient sugar to supply the nation for 90 days.

(3) That the drink-traffic hinders the successful prosecution of the war. It restricts and delays the output of munitions by bringing about bad time-keeping and by lessening industrial efficiency.

(4) That the drink-traffic is a terrible drain on the national economy. In two years of war, more than £380,000,000 has been spent on alcohol. The daily drink bill is over half a million pounds.

(5) That the suspension of the drink-traffic makes for national efficiency. The experience of our Allies is conclusive. In Canada, the sale of alcohol is rapidly disappearing and the result is increased efficiency. The restrictions already imposed in the United Kingdom have been wholly beneficial according to the testimony of the Chiefs of Police, and an extension cannot but result in a further gain of national efficiency.

It is satisfactory to note that the Food Controller of the United Kingdom has reduced the beer output since 1st April, 1917, by 30 per cent with a view to augmenting the supply of barley and sugar for the purposes of food, and economizing transport, labour and fuel. As a consequence of these measures, it is to be hoped that several thousands of public houses will be closed to the immense moral and economical benefit of the people of England.

The testimony of all veteran leaders of the British Army and the Navy points to alcohol as being the greatest weakening factor both as regards discipline and the efficiency of the force. Field-Marshal the late Lord Roberts once said, "Give me a teetotal army and I will lead it anywhere." Lt.-General Sir Reginald Hart observes:—"As an officer, I support temperance because I know that officers and men who avoid drink are physically and mentally more efficient, their nerves are stronger, they march better, there is far less sickness and crime, and their power of resistance is strengthened."

Sir John Jellicoe says:—"As regards straight shooting, it is every one's experience that abstinence is necessary for efficiency. By careful and prolonged tests, the shooting efficiency of the men was proved to be 30 per cent worse after the rum-ration than before it."

Field-Marshal Lord French says:—"Abstinence and self-control make a man more serviceable. If men want to see regiments, battalions, squadrons and batteries smart and efficient, if they have at heart the fame of the glorious regiments to which they belong, they must practise these great qualities of self-control and self-sacrifice."

Field-Marshal Lord Methuen said:—"I appeal to these gallant men who represent this great Empire to act their part as England expects them to do, and throw away from them the vile curse of drink so that they may make themselves fit in body and nerve to face a foe that is as courageous as he is brutal in war."

Field-Marshal the late Sir George White, once the Commander-in-Chief in India, said:—"In the army, there can be no doubt that the safest course to pursue is that of total abstinence"; and the late lamented Lord Kitchener was a strong supporter of total abstinence in the army.

It is to be regretted, in the face of this opinion from such high authorities in military circles, that the campaigns in both tropical and temperate climes are not being conducted on a non-alcoholic basis.

TEMPERANCE WORK IN BENGAL.

I shall now make a brief survey of Temperance work in various parts of the Empire. Time will only permit a brief reference. But what I shall take from the materials forwarded to me is typical of what is going on in many other places than those I shall be able to mention.

The following administrative reforms and changes among others were effected in the province of Bengal in 1915-16 and in 1916-17 :—

(1) The sale of foreign liquor on credit, where there was a license for retail sale for consumption on the premises, was prohibited, except in the case of sales under a hotel license to *bona fide* lodgers in the hotel (*Vide* Government Notification No. 204 T.—S.—R., 21-9-15.).

(2) The rates of duty on the different kinds of foreign liquor were enhanced (*Vide* Government Notification 451., 6-3-16.).

(3) The price of Excise opium was raised from Rs. 8-8 to Rs. 11 with effect from the 1st April, 1916 (*Vide* Government of India Order No. 1185 F. E.)

(4) Restrictions were imposed on the issues of opium to retail shops in two districts in Bengal (*Vide* Government Order No. 2246 S. R., 2-12-15).

(5) Sunset closing has been enforced in some liquor shops in two districts in Bengal (*Vide* Government Notification No. 44 S. R., 7-1-16).

(6) The rate of duty on country-spirit was raised from Rs. 6-4 to Rs. 9-6 per L. P. gallon in the Calcutta district. It has been increased to a little above Rs. 10 from 1st August, 1917, and I understand that if the consumption shows any tendency to increase, it will be further raised before the end of this year.

(7) The country-spirit and drug shops in Calcutta have been settled at " fixed fees" based on the consumption of the previous year, instead of on the "auction system," from 1st April, 1916. The same system has been extended to 24 Parganas, Howrah and the Sadar and Serampur Sub-divisions of Hughli from 1st April, 1917.

(8) With regard to Temperance teaching in schools, it is satisfactory to note that in compliance with the Government Memorandum No. 1850 S. R. of the 24th September, 1915, " instruction in drugs and intoxicants has been provided for in the syllabus of Standards III to VI of schools in Western Bengal, while such instruction has been provided for in Eastern Bengal for classes V to VII in 'A Teacher's Hand-book on Temperance Lessons by Capt. Gourlay, I, M. S."

(9) Excise Advisory Committees were convened for all Municipalities outside the Calcutta district and for all rural areas, with the exception of the Sadar Subdivision of one district only in which there is no Local Board. It has further been decided that in rural areas where there are no Local Boards, Advisory Committees should be constituted on the same principle as in Municipal towns.

(10) In 1915-16, 46 country-liquor and Tari shops, and 15 drug-shops, and in 1916-17, 37 country-liquor and Tari shops, 7 foreign liquor (ordinary retail) shops and 15 drug shops were abolished; 3 country spirit, 2 foreign liquor and 10 drug shops were newly opened during the two years, sanctioned by the Advisory Committees.

Gentlemen, our "All-India Temperance Council" has been unceasing, since its foundation, in its efforts to insist upon Government for the introduction of reform measures in respect of—(1) the institution of Advisory Committees; (2) due recognition of local option in the matter of abolition of old and opening of new shops; (3) the regulation of the hours of opening and closing shops; (4) exclusion of women from places where liquor is sold; (5) appointment of Licensing Boards to control the issue of licenses and the location of shops; (6) inclusion of Temperance lessons in the curriculum of studies of schools and (7) prohibition of sale of liquor to minors. Looking at the administrative reforms and changes recently introduced in Bengal, we can congratulate ourselves that our efforts in the cause of Temperance have not been in vain, that the Government has taken the intiative in all matters in which reforms have been suggested by us, and that, although the quantum of reforms has not hitherto been commensurate with the quantum of our efforts in that direction,

we hope that it will increase in the near future, not only in Bengal but in every other province as well. The "Fixed fee" system in place of the old "Auction system," coupled with the fixation of prices of liquor and drugs for the consumer, will, it is hoped, successfully operate against the tendency towards the increase of consumption of intoxicants. This system is now in vogue in Calcutta; it should be adopted all over the country. A Licensing Board should be created for the chief towns in each Presidency, and the Advisory Boards require further improvement in their constitution and power. The Bengal Rule that liquor shops should not be located near bazars, mills, factories and other places of public resort, should be given a stricter and a wider application; greater regard should be paid to the voice of the local people in the matter of the location and abolition of liquor shops, and a further reduction in the number of shops and in the time-limit of sale should be made. There is, therefore, much work yet to be done, and we must not relax our efforts in pushing forward Temperance work. The progress made up to date inspires us with the hope of greater achievements in the future. We must go on with increasing energy and determination to reach the goal of Total Abstinence, and, God willing, our success is assured.

REVENUE AND CONSUMPTION.

Gentlemen, we have usually relied upon the total of Excise revenue as an indication of in-

creased or decreased intemperance in a province during the year. Although not always a safe guide, yet, basing our calculation upon this standard, we have reasons to rejoice at the improvement effected in Bengal during the last two years in respect of the consumption of liquor and a few other intoxicating drugs. There was a decrease of Rs. 3,33,423 in total revenue from country-spirit in 1915-16 and a further decrease of Rs. 6,20,228 in 1916-17. There was a decrease of Rs. 1,13,858 from the sale of ganja and Rs. 33,779 under the head of toddy in 1915-16, but there was an increase of Rs. 1,05,579 and Rs. 23,803 under the two heads respectively in 1916-17. There was an increase of revenue under the head of opium by Rs. 2,13,254 in 1915-16, but there was a considerable decrease under this head amounting to Rs. 2,65,754 in 1916-17. The consumption of country spirit, ganja and opium in 1915 decreased by 7.3, 17.2 and 17.1 per cent respectively as compared with that in 1914. Measured in quantity, the diminution in the case of country spirit amounted to 1,05,000 gallons in 1915-16 and a further diminution of 3,856 gallons in 1916-17. In the case of ganja, it amounted to 376 maunds, and in the case of opium to 156 maunds in 1915. There was an increase of $11\frac{1}{2}$ maunds of ganja in 1916-17, but in the case of opium, we find a decrease of 160 maunds and 26 seers during the same period. In spite, therefore, of increased revenue from opium during the year in 1915-16, there

was a decided fall in its consumption, and this shows that increased Excise revenue is not always a correct standard of measurement of consumption. The cause of this fall of consumption has been ascribed to (1) increased duty on country spirit and drugs; (2) curtailment of the hours of sale; and (3) serious change in the economic conditions of the people consequent on the War, to which I may be permitted to add a fourth cause, namely, the steady and healthy growth of public opinion against drink and drugs fostered by the work of the various Temperance organizations in the province. In Calcutta, it is extremely satisfactory to note that the reduced consumption in liquor in 1915 and 1916 was 33 and 24 per cent respectively.

The incidence of crime in relation to drunkenness in the Presidency of Bengal shows an average decrease of 1,000 cases during the last two years when there was a corresponding decrease of consumption of liquor. In 1917, a measure of considerable importance was adopted in Calcutta, viz., the prohibition of credit-sale of liquor in hotels, restaurants and foreign liquor-shops, and the restriction of time of sale in theatres, cinemas and other places of amusement.

THE CALCUTTA LICENSING BOARD.

The Calcutta Licensing Board, on which we have had the Secretary to the Calcutta Temperance Federation as our representative since its creation, met several times during the

year and effected changes of site in the case of several liquor, tari and drug shops in this city, cancelled the licenses of a few hotels and restaurants, abolished a number of tari shops, and in a few instances rejected applications for opening new restaurants for the sale of liquor. We must congratulate the Calcutta Temperance Fedeation on the success which has attended its efforts in the matter of the closing of tari shops in Calcutta. The following extract from the Excise Administration Report shows how far its labours in this direction were attended with success :—"The Calcutta Temperance Federation expressed their views regarding tari shops in the city in a memorandum which they forwarded to the Board. Their representative (Rev. Herbert Anderson) subsequently visited most of the sites with the Superintendent of the Excise and Salt, and as a result, several tari shops have been abolished from 1916. The question of sanitary improvement in these shops is receiving special attention".

We are indebted to our able Commissioner of Excise in Bengal for full particulars in regard to liquor and drug shops in a number of towns in this Presidency. From these particulars, we have been able to compare the figures for the average monthly consumption in 1912-13, 1915-16 and 1916-17 of all liquors and drugs. Neither time nor space permits me to lay before you the inferences to be drawn

from the data received. In some cases, they are startling and an effort will be made to follow up the facts, especially where certain towns appear to have increased their drinking habits unreasonably. I shall be glad to supply information to Temperance workers in any of the following places :—Burdwan, Asansol, Bankura, Chinsura, Murshidabad, Mymensingh, Tangail, Faridpur, Barisal, Chittagong, Rajshahi and Jalpaiguri.

A DRY AREA IN CALCUTTA.

A concession of considerable importance and potentiality has been granted to Calcutta in 1917 as an experimental measure by the Excise authorities on the representation made by the Calcutta Temperance Federation supported by local opinion. It has now been decided that a certain area in this town which is bounded on the north by the Beadon Street, on the west by the Chitpore Road, on the east by the Upper Circular Road, and on the south by the Bowbazar Street, should enjoy the benefit of what in America would be called a "Dry Area". This area, which may be called the educational area, includes within it the Calcutta University, all the large colleges and schools representing about 10,000 young men, graduates and undergraduates, four important public squares, and a number of hospitals, churches, mosques and temples ; and the authorities have ruled that all grog-shops and

drug shops shall be removed from this area for a year for the present. The importance of this measure cannot be overestimated, as in the words of our representive on the Licensing Board—"in parts of this area, the social evil reigns supreme and to deal successfully with it, it will be helpful to have already dealt with the drink-habit associated therewith". The authorities have, from time to time, ordered the removal of houses of ill fame and changed the sites of liquor shops from certain localities on the representation of respectable residents thereof, and also from the vicinity of schools and colleges ; but the removal of all grog and drug shops from such an extensive area was never attempted before. We expect great good from this administrative measure ; it will go a great way towards improving the general moral tone of this locality ; it will save respectable residents from frequent annoyances caused by scenes of drunkenness and debauchery ; it will spare the students living in the locality many a demoralising and degrading sight and will be helpful to many people who are not habitual drunkards in keeping them away from within the easy reach of temptation. I have no doubt that the experiment will prove satisfactory on grounds both of general improvement of morality and diminution of crime in that particular locality. The authorities will have no cause to regret their action, and it is to be hoped that similar

experiments will be tried in other areas. All large towns where schools, colleges and boarding houses for students are located, should enjoy this privilege, and this reform should be persistently pressed upon the attention of the Government.

THE VICE OF JUVENILE SMOKING.

There is another matter over which we can rejoice, namely,—the measures recently taken to check the vice of juvenile smoking. This has alarmingly increased among our school and college boys and some urgent and stringent measures are needed to remedy the evil. On the representation of the Anti-Smoking Society of Calcutta, the Director of Public Instruction, Bengal, has issued a circular to all schools and colleges in the province prohibiting the smoking of cigars and cigarettes by boys within the school and college premises and outside. A similar circular is, I understand, in operation in Bihar and Orissa. A leaflet in the vernacular pointing out the evil effects of smoking in early age and inculcating total abstinence therefrom, is in preparation in the Director's Office and will be shortly distributed to all schools for the benefit of the boys. It is satisfactory to observe that Bengal is soon going to have an Act making juvenile smoking penal. The Government of the Punjab is contemplating the passing of a similar measure for that Province.

I cannot, however, let this occasion pass without entering my firm protest against what is being done by certain people, well-meaning though they be, in the name of supplying comforts to our young Bengali soldiers at the front. These young soldiers—some of them merely youths—are, it is painful to observe, profusely supplied with cigars and cigarettes as gifts when they go abroad for service, even by Indian ladies. I say, as a medical man, that this is mistaken kindness and misapplied generosity. Why not substitute the deleterious tobacco by sweets, biscuits, fruits and things of that kind which are agreeable to the palate, nourshing to the body and which give strength and energy for work ?

The Anti-Smoking Society of Calcutta is doing good work in the cause of Temperance. It has been fortunate to secure the good offices of many distinguished citizens of Calcutta as speakers on Temperance and other allied subjects at many public meetings held under its auspices, and men like the Lord Bishop of Calcutta, the Sanitary Commissioner with the Government of Bengal and many eminent physicians and surgeons of this town have extended their sympathy and active support in the organization of these meetings which are very helpful in disseminating the knowledge of Temperance among the student community of Bengal.

TEMPERANCE LITERATURE.

The sale of Temperance literature in Bengal

is indeed very promising. Three thousand copies of the Bengali edition of "Haridasi", a touching story of evils and misery caused by drunkenness in family life, were sold within the first two years of its publication, and a second edition was brought out in 1916. The merit of the book can be judged by its having been translated into several vernaculars of India and also in English, and the demand for these is increasing. Lantern lectures illustrating the scenes of the story are being given by the Assistant Secretary to the Calcutta Temperance Federation, and they are very much appreciated. Besides the above, many vernacular and English leaflets on Temperance are being widely distributed in the province.

In this connection, we cannot be sufficien thankful to our sisters of the W. C. T. U. their splendid work in the cause of Temperance in Bengal. It is through their exertion that the vernacular edition of "Haridasi" has had such an extensive sale. They are carrying on propaganda work satisfactorily with the help of magic lantern slides, vernacular talks, leaflets, booklets, etc. The appreciable decrease in the number of liquor shops and gambling dens in the district of Howrah which is largely inhabited by millhands, is due in part to their noble exertion.

Mrs. Donald Sunder, Corresponding Secretary, W. C. T. U., writing about the work of the Union, says :—"I wish to mention

that our work during 1916 and 1917 has progressed well. Our work in India is done under eighteen separate departments, each department being in the charge of a "committee of one" called a superintendent. During the past two years, that is, 1916 and 1917, special effort has been made in the lines of Juvenile work, in printing and distributing Temperance literature and in securing signatures to the Total Abstinence Pledge. Good progress has been made in these special lines as well as in all our departments of work."

Medal contests are also being held annually under the auspices of the Calcutta Temperance Federation, the W. C. T. U.'s and the New Dispensation Band of Hope in Temperance recitations and essays, open to boys and girls of all schools in Calcutta. The Calcutta Temperance Federation awards two medals annually—the Kottlingham Medal and the Dr. Harold Man Medal.

TEMPERANCE IN THE UNITED PROVINCES.

Our good sister, Mrs. F. B. Price, the energetic Secretary of the "Lucknow Temperance Federation," has kindly furnished me with the following particulars regarding Temperance work in her Province :—

"The Women's Christian Temperance Union is organized and active in many centres of these Provinces. There are a good many Indian Unions which are doing good work. Our line

is especially in teaching the children through songs, recitations and Temperance lessons and literature and enlisting them on the side of Temperance. Medal contests have been held in different places, especially in Naini Tal, where conditions are very favourable to such effort, during the summer months. The Unions of Naini Tal, Mussoorie, Lucknow and Allahabad especially have undertaken to inform themselves concerning local conditions and petition the proper authorities for further restrictions to the sale of strong drink. The Women's Christian Temperance Union has also started on foot a petition to the Legislative Council for a Juvenile Smoking Bill similar to that about to be passed in the Punjab. Temperance literature is distributed both in English and the Vernaculars, many pledges secured and public meetings held. Many copies of "Alcohol and the Human Body" have been sold and are in use. A Temperance Programme was prepared and used on one of the Sundays in November both in English and Hindustani services. "The Temperance Record and White Ribbon" has larger circulation than formerly in these Provinces".

"As to the work of the Temperance Federation in Lucknow : It was organised last April and through the efforts of its Vigilance Committee, the Magistrate promised that from the 1st of April, 1916, there should be 13 fewer

drink-shops of sorts than are now in existence, and through the efforts of the Federation, one restaurant where drinks were to be sold, on a principal street of the city, was abandoned. The man who had obtained the licanse returned it, receiving what he had paid for it. He said that everybody was against him in Lucknow, and left the place. The Federation includes representatives of many different organizations from which I presume you will secure reports. Perhaps our most successful public meeting of the year was when Dr. Harold H. Mann spoke to a large audience of students and others on the topic "Temperance and the War". Oratorical and Essay Contests in the city of Lucknow are planned for, and many college students are keen on taking part in them".

In Benares, the Temperance Council has been bringing local vendors to book by reporting cases of selling liquor after prescribed hours, and of supplying minors. Over thirty cases have been dealt with and convictions secured. Temperance workers should avail themselves much more largely of the concessions of reporting any kind of such administration granted to them under most Excise Rules and Regulations. The authorities are glad to have illicit measures or the infringement of Rules brought to their notice, and a good deal of practical and useful Temperance work can be

done if vendors of drink and drugs are made to abide strictly to the terms of their licences.

The Secretary to the Cawnpore Temperance Union informs me that the city was fortunate in getting rid of one liquor shop in 1916, and the Commissioner of Excise has now intimated that another shop will be abolished from April 1918.

TEMPERANCE IN GWALIOR.

The "All-India Kayastha Reform Association" which has its head-quarters in Gwalior, is to be congratulated on the good work done by it among the members of that particular community. In the last report published in 1917, Mr. Lalita Prasad Saxena, Joint Secretary of the Association, has recorded that the pernicious practice of wine-drinking in public on the occasion of the "Holi" has died out of the community. Every social feast used formerly to be tainted by the public habit of wine-drinking, but all feasts are now free from that evil practice.

TEMPERANCE IN C. P.

Miss R. E. Taylor, Secretary of the Sironcha Temperance League, in forwarding to me a brief record of the Temperance activities in her district, says that drink is hugely on the decrease and that there is strong probability of some of the shops being closed shortly on this account.

TEMPERANCE IN MADRAS.

The state of things in Madras cannot be said to be as promising as in Bengal. In spite of the strenuous efforts made by the Temperance organisations in the Province under the able guidance of the President and the Secretary of the "All-India Temperance Conncil", the consumption of country liquor in the town of Madras has increased during recent years, being more than doubled in the period between 1900 and 1915, although the increase in the population during this period has been under 2 per cent, and in spite of considerable reduction in the number of Arrack shops and the increase of duty from Rs. 5-10 to Rs. 8-2 per gallon. Now this is a very serious state of things and ought to be looked into at once. I am glad to state that the Government of Madras have appointed a Committee to make a full enquiry into the matter and submit a report at as early a date as possible. It is a matter of regret that while the trade has a representation on this Committee, the Temperance force of the city is unrepresented. We hope more stringent measures than have hitherto been adopted, will soon be taken by the authorities to put an effective check to the spread of drunkenness in the city, and our activities should also be pushed on with much greater vigour than before.

It is satisfactory to note that the constitution of Excise Advisory Committees in the Madras Presidency has been improved and that the Government has under its consideration the question of establishing an Excise Licensing Board in Madras on lines similar to the one existing in Calcutta. We trust it will be found possible that not only Madras but all the other chief towns of India will soon enjoy the benefit of a Licensing Board to control and regulate the sale of liquor and drugs.

The Madras Temperance League, the Chicacole Temperance Association and other local organisations are doing good work in the cause of Temperance. Lantern lectures are being delivered to depressed classes to explain the value of temperance and to create an aversion for drink and drugs. Mr. Selvaraju and Rev. Mr. Moffatt are taking much interest in propaganda work. The W. C. T. U. of Madras, in conjunction with other Temperance organizations, has just held a most successful Temperance Exhibit in connection with the Madras Industrial Exhibition which had the honour of being recently opened by His Excellency the Viceroy. The "Sri Jnanodaya Samaj" has for its object the promotion of Temperance and elementary education among the community of fishermen in Mangalore, and it has been able to wean away a large number of men belonging to this community from the temptation for drink. This society has been able to enlist the sympathy of

the Director of Public Instruction of the Province, who has kindly sanctioned a grant of Rs. 1,200/- during 1916 towards the cost of construction of a Temperance Hall. As regards Temperance literature, it is to be noted that the Temperance organisations have published many booklets and leaflets in the vernacular languages of the Province for distribution among the people.

We would call the attention of the Municipal Boards and Councils in various parts of India to the action of the Chicacole Municipal Council which recently passed the following Resolution, 10 out of 12 members voting for it :- "This Council is of opinion that it is desirable to abolish all arrack, ganja and opium shops within this Municipality, and in view of that conviction, the Council has no remarks to offer regarding their number and location." A memorial is also being sent to the Governor of the Province praying for the abolition of all shops in Chicacole.

TEMPERANCE IN MYSORE

The Government of Mysore has declared that it is in entire sympathy with the proposal of local option. The Dewan of Mysore, in a speech delivered at the Representative Assembly, said that the Excise Commissioner is prepared to enforce the principle of local option and the authorities would abolish a shop if the demand is supported by unanimous local opinion. Already a beginning has been made there which has caused some loss of revenue to Government. The Mysore Government have also appointed Licensing Boards for Bangalore, Mysore and Kolar Gold Fields whose function is to determine the number and location of taverns ; it is also contemplating the introduction of the "fixed fee system" into the State. These reform measures will, it is hoped, reduce the consumption of liquor in Mysore where it has grown rapidly during recent years.

TEMPERANCE IN THE PUNJAB.

Temperance work is going on satisfactorily in the Punjab. In reviewing the Annual Report of the Excise administration of the Punjab, His Honour the Lieutenant-Governor of the Province observes that the year 1915-16 was marked by a further decrease in the consumption both of country spirit and opium. The former has gone down by 3,31603 gallons, a decrease of 13 per cent.

Amritsar now enjoys the unique privilege of being rid of all grog and drug shops from within its municipal limits. The local Temperance organizations are active in their propaganda work, and lantern lectures freely given by Mr. Nand Lal, Secretary of the Amritsar Temperance Society, and Mr. Sant Sing, Secretary of the Temperance Federation, educate the masses in the subject of Temperance ; and recently bioscope films are also being

utilized for the purpose. Temperance teaching is being vigorously promoted in many of the schools and colleges. A spacious and magnificent hall has been built by the Amritsar Temperance Society for Temperance work, and it was opened in April 1916 by Mr. King, the Deputy Commissioner, through whose influence the liquor shops have been removed from the city.

The 27th Anniversary of the Amritsar Temperance Society was celebrated in November 1917 under the presidency of Mr. F. H. Burton, I. C. S., Deputy Commissioner, Amritsar, who distributed certificates to many Temperance workers of the province in appreciation of their good services.

A Temperance Council for the Punjab has been formed in Lahore with Dr. Ewing as President and Pandit Bishen Narain Rozdon and Rai Saheb Prof. Ruchiram as Vice-Presidents, to co-ordinate, strengthen and extend the work of the existing Temperance societies and to stand between the Anglo-Indian Temperance Association in London and its affiliated branches in that Province.

Preaching among prisoners in the Lahore Borstal Central Jail is being done, and similar work in addition to lantern shows is also done at the Criminal Tribes Reformatory Settlements at Amritsar.

The Dev Samaj, the Punjab Temperance Society, the Annual Caine Temperance Fair, the Guzranwalla Temperance Society and the Pathankote Temperance Society are all doing useful work among the people of the Punjab. Pathankote, like Amritsar, has also got a new Temperance Hall through the exertions of Miss Mary Campbell, Secretary to the local Temperance organization. Mr. Watson, the Deputy Commissioner, who formally opened the Hall on may 29, 1916, paid a glowing tribute to Miss Campbell for her services to the cause of Temperance. The day before, the Commissioner of the district presented her with a "Kaiser-i-Hind Medal", awarded by Government in recognition of her special efforts in the cause of Temperance.

It is satisfactory to note that in the Punjab, liquor licenses have been withheld on the occasion of religious festivals and fairs.

TEMPERANCE AT SIMLA.

A Temperance Federation has been organized at Simla with Rev. A. W. Buckley and Rev. J. G. Potter as President and Secretary respectively, and it has been affiliated to the Anglo-Indian Temperance Association. The inaugural meeting was held in May 1917, and was presided over by Col. Burlton, Deputy Commissioner, Simla, who was all sympathy with the movement and would "welcome any information which the friends of Temperance

could supply, so that he could, when necessary, take official action to deal with the drink question in Simla". A representative vigilance committee has been appointed, and the authorities have been approached with a proposal to form an Advisory Committee for Simla.

TEMPERANCE IN BURMA.

Burma is not lagging behind in Temperance work. The Burman Youths' Temperance League is one of the most active organizations in that part of the Indian Empire. "Young Burman" is the official organ of the League which is trying to win influential persons in the Temperance cause and is collecting opinions and information in support of the closing of liquor and toddy shops in the country.

TEMPERANCE IN CEYLON.

The Temperance reform measures adopted by the authorities in Ceylon are important. The Governor has appointed a Commission to enquire into the sale and manufacture of intoxicating liquors in the island, and we hope the enquiry will lead to the adoption of measures effecting an appreciable reduction in the consumption of liquor. The Government has also announced that, in future, the Advisory Boards will in every case have an unofficial majority, and has further decided not to issue "off" licenses to Arrack taverns.

TEMPERANCE IN BOMBAY.

The Bombay Social Service League is doing good work in the cause of Temperance in the town of Bombay. Its last quarterly report (Oct. 1917) shows that "consumption both of toddy and drugs has decreased much". Temperance instruction is being spread among the working classes by means of popular addresses and lantern lectures.

At the Bombay Conferance held in Oct. 1916 under the presidency of the Hon'ble Mr. G. K. Parekh, considerable attention was paid to the subject of liquor and drug consumption in the province, and several resolutions were adopted at the meeting asking for—(a) the right of local option; (b) majority of non-official members on the Advisory Committees; (c) earlier closing of shops on holidays; (d) Temperance teaching in schools and colleges; and (e) more vigorous voluntary Temperance work among the people and specially among working men.

The Secretary of the Surat Temperance Association informs us that a Temperance monthly is being published there and night-schools are being conducted for the backward classes at which the Temperance cause is being

preached. Preachers and lecturers have been appointed to deliver short addresses on Temperance in the various parts of the city and district, and leaflets in the simplest vernaculars of the province are being distributed.

In Ahmedabad, meetings were held in localities inhabited by people much addicted to drink. More than 200 persons signed the Temperance pledge. Two liquor shops were removed, on the representation of the Ahmedabad Total Abstinence Association from main roads to less objectionable sites. Meetings among the depressed classes were held, and many villages visited and Temperance lessons preached.

THE ANGLO-INDIAN TEMPERANCE ASSOCIATION AND OURSELVES.

Gentlemen, we can never be sufficiently thankful to our Parent-Society, I mean the Anglo- Indian Temperance Association, for the keen interest it takes in the cause of Temperance in India, and for the very valuable help rendered to us whenever any occasion has arisen. Many of the administrative reforms which we now enjoy may be traced to the unceasing efforts and influential support of its President Sir Herbert Roberts, M. P. (now Lord Clwyd) in Parliament and with the Government at home. Its admirable organ, the 'Abkari,' is most helpful

in advancing the cause of Temperance in India. When its devoted Editor, Mr. Grubb, completed his 25 years' connection with the journal, he received warm congratulations from the Association, in which congratulations Temperance organizations all over India are proud to join.

MR. CHARLES ROBERTS' VISIT TO INDIA.

We heartily welcome the visit of the Right Honrable Mr. Montagu and Mr. Charles Roberts, M. P., to India. They will have but little time to study the drink problem of India in situ, as their visit is short and their mission appears to be mainly political, but we earnestly hope that this visit of theirs will be fruitful in bringing forth measures leading to further diminution of the consumption of drink and drugs in India. Mr. Charles Roberts was entertained at a Social by the Honourable Dr. D. P. Sarbadhikari, the esteemed President of the Calcutta Temperance Federation, during his recent visit to Calcutta. The gathering was large and representative, and Temperance workers in the city, through the Rev. Herbert Anderson, had an opportunity to place their views before him and to ask for his sympathy and influential support in the furtherance of their object.

DEATH OF DADABHAI NAORAJI.

We have sustained a heavy loss during the current year by the death of one of India's

greatest sons, the late Mr. Dadabhai Naoraji. He was one of the greatest champions of the Temperance cause both in England and in India. "His life-long personal abstinence, his unswerving advocacy of Temperance, his spotless life, and his devotion to the promotion of India's moral and material welfare, will ever be an abiding inspiration to his countrymen for generations to come."

OUR RESPONSIBILITIES.

One more word and I have done. No official measures, however, strong and comprehensive they be, can ever make a nation sober. We must ourselves work out our own salvation. Any reform, if it is to be thoroughly successful, must begin from within and supplemented and supported by outside help. The moral consciousness of the people should be roused. The ancient traditions of India regarding the use of drink and drugs should be revived; the religious interdictions should be aggressively preached throughout the length and breadth of the land; Temperance teachings and ideals should be introduced not only in schools, but they should find a place in all forms of popular instructions and amusements such as *jatras*, *kathakatas*, *sankirtans*, cinemas, etc., so that the evils of intemperance are brought home to the masses and made to leave an indelible impression on their minds. Such institutions as the Social Service Leagues of Bengal and Bombay and

the Calcutta Workingman's Institution are suitable organizations to reach the masses in the crusade against intemperance. Every school founded by these organizations for the benefit of the working classes should be made a centre for the spread of Temperance lessons in the neighbouring area. Counter-attractions in the form of tea-shops and amusement halls should be established in all mill centres, and innocent amusements, such as music, bioscopic shows, indoor games, etc., with a good and cheering cup of tea should be provided for the visitors at a nominal cost. The extremely insanitary conditions of the *bustees* where our poor workingmen live and the wretched, ill-ventilated and filthy dwellings, generally occupied by them with large families, exert a depressing influence on the health and moral of the occupants and induce a habit of intemperance and growth of other social vices in them. Added to this, the unhealthy surroundings of the work-places and the pressure caused by long working hours generally have a very depressing effect on the workers. After the day's wearisome work, the individual seeks for something to revive and refresh himself; and in the absence of anything of a healthy character, he generally takes to drinking and goes to grog shops and other objectionable places for recreation and pleasure. This is one of the causes of the increase of drink-habit among our working population, and it

behoves us to see that rest-halls with suitable forms of entertainments are provided for our working classes in the localities in which they live. These are expected to attract them and keep them away from drink, drugs and gambling. We should also do our best to improve the unhealthy conditions which surround their habitations and their work-places. Such work will require both men and money, and if we are earnest workers, we must be prepared to provide for both. We must not consider our duty to our erring brothers terminate with our lectures at Temperance meetings and our attendance at this annual gathering of Temperance workers. We must do something more. We must collect sufficient funds for the purpose and try to win the younger generations to help us in the Temperance work; there we have a splendid material to work upon, and it can be turned to the best advantage for the educational, economical and moral regeneration of the masses. Our young men should come forward in their thousands and help us in our propaganda work, and with their help we should be able to spread the net of Temperance work broadcast over India and secure a good harvest to the nation's credit and to the glory of God.

We received last week with amazement and joy the news that the House of Representatives in Washington had adopted by 282 votes to 128 a resolution prohibiting the manufacture and

sale of intoxicants throughout the United States and that the Senate had accepted the said resolution. I foresee, Ladies and Gentlemen, the time when the Imperial Government of India will face the same problem in the same way, and though we may not live to see that happy day, let us work on quietly and hopefully so that our children may be exultant as the good news is cabled throughout the world that the Empire of India has joined the wisest nation of the world in prohibiting throughout its borders the manufacture and sale of intoxicants.

Growth of the Drink and Drug Trade among the Educated Community of Bengal.*

At the Temperance Conference organised by the Calcutta Temperance Federation and held at Calcutta on the 22nd November, 1919, the subject of the growth of the drink and drug trade among the educated community of Bengal was thoroughly discussed. The idea is a new one to the Indian public, if not to the Government, and may be taken as an innovation in the Excise policy of the Government.

It was only three years ago that some of our University graduates took it into their heads to apply for licenses for the sale of opium, ganja and charas, and only during last year, licenses for the sale of country liquor were taken out by some of the B.A.s and M.A.s of the Calcutta University. It is, therefore, very desirable that the question should be fully discussed while it is still on an experimental stage and any well-considered decision arrived at as to its adaptability or otherwise to

* The Modern Review, January, 1920.

the special conditions of our country would, I am sure, be welcome both to the Government and the public at large.

It will be seen from the statement circulated by the Calcutta Temperance Federation that for the last two years, experiments have been made with the B.A.s and M.A.s of our University as vendors of these excisable articles. The results were closely watched and it is reported that no decided improvement has been effected by the introduction of these educated people as vendors of these articles from Temperance point of view. We can, therefore, take it for granted that the experiment so far has not produced hopeful results. Nevertheless, the measure is being given a further trial.

At present, fourteen of our graduates are engaged in the Drink and Drug trade in Calcutta, of whom six are B.A.s and B.Sc.s and the rest are M.A.s and M.Sc.s. One of these gentlemen is a teacher in a High School in Calcutta.

The question may be considered from two aspects, viz., (1) its *Trade* aspect and (2) the *Moral* aspect.

So far as the first aspect is concerned, I must say that, taken generally, there is not much to object to the measure. One trade, from the business point of view, pure and simple, is as honourable as another, provided it is carried on with honesty and straightforwardness. An honest shopkeeper, to my mind, is as good and

respectable a member of the community as a person belonging to any of the so-called honourable professions. When, therefore, the trader possesses good educational qualifications, it is not only an advantage to his business in many ways but it also raises expcetations in the minds of the public that his dealings would be honest and straightforward, although disappointment is by no means rare in one's expectations in this respect.

It cannot, however, be denied that there are certain trades which from their very nature tend to blunt our moral sensibility, however honestly they may be carried out, and no wonder, therefore, that these have at all times been looked down upon by the community. One of these, for example, is the trade of a butcher. There are butchers, no doubt, who are as honest in matters concerning their occupation as any other person carrying on a more humane trade, but it can hardly be denied that the gentler feelings of humanity become somewhat dull or deadened in the butcher, simply on account of the peculiar character of his occupation, and pain and death do not appeal as eloquently to his moral consciousness as on any other member of the community. It is on this consideration I think, that in certain countries, butchers are not allowed to sit as Jurors in murder cases.

A publican likewise does not command that amount of respect and sympathy which is shown to the ordinary traders in a country and his

position in society is also inferior. It is particularly so in India. In the sacred books of the Hindus, it is enjoined "मद्यमपेयमदेयमग्राह्यम्" —"Wine should not be drunk by anybody or given to anybody or accepted by anybody." People trading in liquor in India form a separate low caste by themselves called the *Soundiks* or *Soorhees*. The trade is so very repugnant to the ordinary notions of the community that from very early times, those who carried on the liquor-trade have been considered an unsociable and untouchable lot with whom the other members of the community would not eat or drink or mix in society. This repugnance is in the main due to their dealing in an article of trade which is so injurious to the well-being of the community and to their getting rich at the expense of the physical, moral and social good of their fellow-countrymen.

Drinking habit is a human frailty and seems to be as old as the history of humanity itself. There never was any time or place in the history of the world in which humanity was altogether free from this weakness. Drinks were made or manufactured in India in remote ages and, of course, there were people who used to partake of liquor. But the evil habit seems to have been confined to a small proportion of the population. The majority of the people not only did not drink but tried to do what they could to create an aversion and hatred against drink, as well against its trade as against the people who carried on such trade.

To familiarise oneself with an evil thing is to lose much of the aversion against it. It might gradually lead to one's liking the thing, and in the end, to be in love with it. Our forefathers took note of this simple truth and by carrying on a social warfare against those that carried on the drink trade, tried to protect society as much as possible against the insidious attack of a *poison* which would destroy the moral, physical, social and spiritual happiness of the people.

The question now is—are we prepared to see our educated young men who are the future fathers of the race, to be associated with an article of trade as degrading as it is dangerous, so that not only they but their children, their relations and their friends would become familiar with this subtle poison, or do we wish that they should keep themselves aloof from this dangerous occapation for a living?

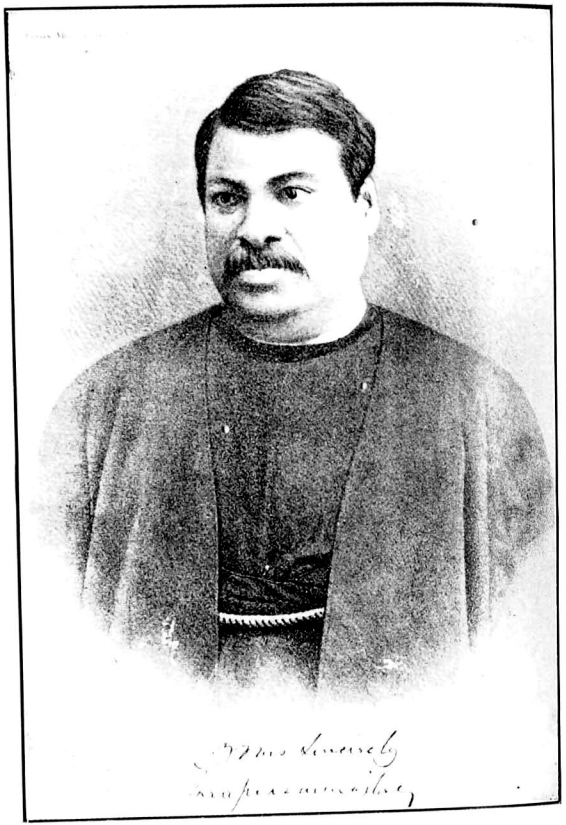
I may be permitted to observe that the adoption of this trade by the present batch of our educated young men can hardly be attributed to any laudable desire on their part of minimising the evils of the drink and drug habit among their countrymen by strictly carrying out the regulations of the Excise Act. It appears from information at our disposal that the main reason for their taking up this trade is *to make a maximum profit out of a minimum capital.* One of them writes:—"I have taken to this sort of living purely from the business point of view, because it enables me to draw the maximum profit with a minimum capital." Another says:—"The main reason for my taking up this line is that we can have maximum profit with a minimum capital." A third writes;—"I am driven to take up, though with much reluctance, the business as an economic factor—more profit with a small capital." One can draw one's own conclusion from these candid confessions.

Taking all the circumstances into consideration, I would leave it to the Indian public to decide whether it is worthwhile, in the interest of the liquor-trade only, "*in order to get rid of unnecessary trouble experienced by the Excise Staff and of the dishonest practices in the shops resorted to by greedy and dishonest Vendors,*" that our educated young men should be exposed to such temptation and be initiated into a trade whose ultimate consequences are sure to be very disastrous.

The public agitation against the innovation has not been without effect. One of the educated vendors, a professor in a college, in deference to the agitation in the papers, has since given up his license and has once again returned to his honourable and quiet profession of teaching. The position of a teacher carrying on this trade is particularly harmful and embarrassing. He may have to teach Temperance lessons in his class and the pupils will at once see that *precept* and *example* do not coincide in the case of their teacher.

I hope I have been able to place before my readers both sides of the case in as fair a manner as I could. It is now for the educated Indian people to discuss the matter in all its bearings and come to a well-considered decision which will be helpful in advancing the cause of Temperance in India.

BIOGRAPHICAL



Rai Taraprasanna Roy Bahadur, L.M.S., F.I.C., F.C.S.

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Rai Taraprasanna Roy Bahadur.*

Rai Taraprasanna Roy Bahadur, L. M. S. F. C. S., F. I. C., F C. U., was born in Calcutta in the year 1844, in the house of his maternal uncle, the late Babu Madhub Chandra Sen.

His father, the late Babu Sarada Prasad Roy who was an assistant in the Bank of Bengal, belonged to a respectable and well-known Baidya family in Kanchraparah.

Dr. Roy is connected by family ties with several well-known Baidya families, being related on his mother's side with the Sen family of Culootolah, the family to which the celebrated Keshub Chunder Sen belonged. Several other members also of this family, though hardly so well-known as Keshub Chunder Sen, were men of considerable merit and influence and acquired positions of trust and responsibility. One of them, Ram Kamal Sen, was the Dewan (Treasurer) of the Bank of Bengal, Calcutta, and another, Hari Mohan Sen, was the Prime Minister of Jaipur.

Dr. Roy was educated at the Hare School, from which he proceeded in due course to the Calcutta Medical College. His college career lasted the usual period of time and was of a decidedly brilliant nature, for he won numerous medals and prizes and succeeded in acquiring not

* The Indian Medical Record, June, 1895.

only the approbation but also the confidence of his professors. Of this, a very signal proof was given by the fact that while still only a senior student, Taraprasanna Roy was permitted to act for two months as Dr. Partridge's House Surgeon in the Medical College Hospital.

Professor BOWEN PARTRIDGE acknowledged his appreciation of young Taraprasanna's work in the following terms :—

"During the time that TARAPRASANNA ROY has acted as Assistant in my Ward, he has fully maintained the reputation which he has previously earned for himself in the College. As a student, he has been most distinguished, having carried off many of the College prizes, and having in the examination of the Calcutta University, obtained the University scholarships in Physiology and Comparative Anatomy. As my assistant, he has shown that he is not merely a reader but a worker."

At the Final Examination which he passed in 1867, Dr. Roy stood first. He was awarded University Honours in Medicine and obtained thereby a scholarship of Rs. 40 monthly, tenable for two years. After qualifying, he entered Government Service, and in January, 1868, was posted as House Surgeon to the Calcutta Eye Infirmary under Dr. CHARLES MACNAMARA.

After two years' work in the Eye Infirmary, he accepted the appointment of Assistant Professor of Chemistry under Dr. F. N. MACNAMARA, who was also Chemical Examiner to

Government. This was in 1869 and from that time until his retirement (due to ill health) in March, 1894, a period of 24 years, Dr. Taraprasanna Roy worked continuously in the Government Chemical Laboratory in Calcutta.

As already stated, his first appointment was that of an Assistant Professor. In 1873, he became Assistant Chemical Examiner in addition to his other duties, and in 1876, he was appointed Additional Chemical Examiner. This appointment under the title of "A Chemical Examiner to Government" he held up to the day of his retirement.

The earlier years of his service were thus associated with, the two MACNAMARAS, for whom he has always cherished the greatest admiration and esteem. That these feelings were deep and sincere, any one who talks over old times with Dr. Roy cannot fail to discover, and that the esteem was mutual will be evident from the interesting letter written 20 years ago. Dr. C. MACNAMARA thus wrote in 1874 :—

" Babu Taraprasanna Roy was for some years my Assistant in the Calcutta Eye Infirmary. I formed the very highest opinion of his ability, industry and integrity, in fact I cannot speak too highly of him."

On sevral occasions, Dr. Roy officiated as Chemical Examiner to Government, and druing 1877, acted as Lectuer in Chemistry and Medical Jurisprudence at the Campbell Medical

School. He was an Honourary Lecturer in Chemistry at the Indian Association for the Cultivation of Science, and for many years has been Analyst to the Oriental Gas Co. Ltd. In 1884, a medal was awarded to Dr. Roy by the Committee of the International Exhibition held in Calcutta in that year, for the valuable collection of *indigenous poisons* which he had contributed.

His scientific attainments have, in addition, been recognized by English Chemical Societies. For he was elected a Fellow of the Chemical Society, London, and a Fellow of the Chemical Institute of Great Britain. The latter distinction is enjoyed by only a few of his fellow countrymen. Dr. Taraprasanna Roy was also a Fellow of the Calcutta University. In 1889, Dr. Roy's services were signalized by the distinction of *Rai Bahadur* being conferred upon him by the Government of India.

In 1888, the onerous and unhealthy nature of the work which obliged him to pass six hours daily in the vitiated atmosphere of the Medico-legal laboratory, began to tell upon Dr. Roy's health. He broke down and was obliged to take a year's furlough. Rejoining in 1889, he discharged the duties of his office for the next five years, but again became so seriously ill that he was compelled to retire in March, 1894, on pension which, let us hope, he may live to enjoy for many years to come. *

* Dr. Roy died on the 22nd March, 1897.—*EDITOR.*

Dr. Jogendra Nath Ghosh, I.M.S.

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The Late
Dr. Jogendra Nath Ghosh.*

I knew the late Dr. Jogendra Nath Ghosh and I knew him well. To know him was to love him and to respect him.

His life is full of good lessons which the younger generation of medical men would do well to study.

He was not born with a silver spoon in his mouth. As a student, he had to contend against many adverse circumstances but he got over them by patience, perseverence and industry. He was truly a self-made man. Born of a respectable Kayastha family but of very limited means, he lost his father while he was a boy. He had thus to depend mainly upon his own scanty resources and on the casual assistance from friends and relations to enable him to prosecute his studies in Calcutta. And they were glad to help him, as they saw in him the promise of a good and useful career and his loving and gentle nature made him liked by all. I did often hear him speak, in most endearing and grateful terms, the kind services rendered to him during his student-life in Calcutta

* The Calcutta Medical Journal. July, 1913.

by one of these gentlemen. He was a man who could never forget a kind act.

Dr. Ghosh had a great many virtues and few faults. As a family man, he was a fond and affectionate husband, a most loving father, a generous neighbour, and a kind and warm friend heartily participating in your joys, and ever ready to stand by you in your troubles.

As a physician, though not of exceptional ability, he had an endless stock of practical common sense which stood him in good stead and made him a successful practitioner. He belonged to that good old type of physicians whom it is our misfortune to see fast passing away. His wide hospital experience and his sound judgment helped him to grapple successfully with difficult cases, and his gentle nature over-flowing with the milk of human kindness, his naturally quiet movements in the sick room and his kind words of comfort and hope gently whispered into the ears of the desponding sick man, easily won for him the confidence and the good will of the patient and his friends and enabled him to enter many a house where higher professional skill and reputation failed to gain access.

He obtained his License in Medicine and Surgery in 1873 and immediately after, joined the Government Service which was spent

wholly in Calcutta. He began his life as one of the House Surgeons in the Medical College Hospital, and then joined the Campbell Medical School and worked there in various capacities, his last appointment being the Chair of Midwifery which he held up to the day of his retirement in 1898. Hundreds of students who now hold important posts under Government or occupy respectable positions in the profession, claim him as their preceptor and guide. Not the least among them is the Hon'ble Dr. Nil Ratan Sircar M.A., M.D., who is now one of the leaders of the Indian medical profession in Calcutta and of whom we are justly so proud. Dr. Ghosh was an active member of the now defunct Calcutta Medical Society which was the only learned Medical Society of its kind in those days and which used to hold its meetings at the Medical College. He investigated into the subject of billiary cirrhosis in children which at one time prevailed to an alarming extent in Calcutta, and read an interesting paper on this subject at the sitting of the first Indian Medical Congress in 1894.

As a citizen, he was always mindful of his duties. He served the people of Calcutta as one of the City Fathers, long and faithfully. He was not proficient in the art of making public speeches, but he earnestly entered into all important Municipal questions and tried to discharge, to the best of his light

and ability, the trust imposed upon him by his constituency. He was one of those Commissioners who enjoyed the unique honour of being elected by the same constituency, practically unopposed, for the last 20 years.

I knew him well in connection with the Calcutta Medical Club. He was one of its Secretaries, which office he held from its foundation to the day of his death. His zeal and enthusiasm for the advancement of the Club were unbounded, and the keen interest he used to take in the young institution was almost paternal. There was no member in the Club who could more successfully throw oil over troubled waters than Dr. Ghosh, and he never grudged any personal service, however irksome it might have been, to settle differences and bring matters into normal condition. A more regular attendant at its meetings the Club never had, and he was the life and soul of all social functions held under its auspices. To sign the subscription receipts at the beginning of each month took much of his valuable time, but he never grudged it and was often heard to say that he wished the number of these would increase and exact more of his time. By his death, the Calcutta Medical Club has sustained a loss which it would be difficult to fill in for a long time to come.

His social virtues were of a high order. You could trust him with the management

of a social function, be it a marriage or a *shradh*, an evening party or a dinner, and none had ever any occasion to regret such trust. He was a good organiser and was most successful in the management of such functions from points of view of both economy and comforts. His resources in such matters seemed to be illimitable and these he could readily bring to bear upon the undertakings, which invariably contribuuted to their success and for which his services were eagerly sought for by his friends and relations.

He suffered from diabetes for a few years before his death and this induced him to retire from Government Service before the completion of his full term. In spite of the disease, however, he used to work hard and could undergo fatigue and exertion to a surprising extent whenever his services were requisitioned for any work of public utility.

Dr. Ghose knew what the pinch of poverty was like, and he was ever ready in his better days to relieve the distress of others. He took a keen interest in the work of the Ram Krishna Anath Bhandar of Bow Bazar, and through it, was the means of alleviating the sufferings of many a poor widow and helpless orphan.

During the closing years of his life, the sudden and rather intractable illness of his

eldest son considerably alarmed him and caused him much worry and anxiety which insidiously affected his health. He took his son for a change of air to his hill residence at the Baidyanath J nction, where he himself fell ill and died of heart-failure before his friends in Calcutta became aware of his illness. He has left a widow, a daughter, two sons and a large circle of friends and relations to mourn his loss. May his soul rest in peace.

Prof. Benoyendra Nath Sen, M. A.

Benoyendra Nath Sen*

Prof. Benoyendra Nath Sen held a very high place in the affection and regard of the educated youngmen of Bengal and was admittedly one of their best friends and a most trusted leader. His life is a source of perennial interest and inspiration to his countrymen, young and old, and it is proper that we should meet, at least once a year, to pay our respects to his hallowed memory and draw inspiration therefrom to improve and elevate our own lives. The Calcutta University Institute owes a great deal of its popularity, usefulness and prosperity to Prof. Benoyendra Nath Sen's untiring exertions and devoted labours as one of its past Honourary Secretaries. It is, therefore, a matter of great satisfaction to find that the Institute has taken upon itself the duty of organising annually a meeting on the 12th day of April to solemnly observe the death anniversary of Prof. Sen and has founded a scholarship in his name to be managed by the Students' Fund (which he himself started) to help a poor student in the prosecution of his studies. For this, the Calcutta University Institute deserves our best thanks.

* Presidential address delivered at the fifth death-anniversary held at the Calcutta University Institute on the 12th April, 1918. Mr. Sen was for many years the Professor of History and Political Economy at the Presidency College, Calcutta.

The lives of great and good men are valuable assets not only to the nation to which they belong but to the world at large, because such men live, not for their places of birth or their people alone, but for the humanity at large. All men, directly or indirectly, are benefited by their work and by their example. Such a life was led by Prof. Benoyendra Nath Sen. He was an ideal teacher, an educationist in the highest sense of the term, a practical philosopher, a man of high moral principles, of great strength and purity of character, of high spiritual culture and a most kind and helping friend. Of him it might truly be said that he was dead to self and lived for others only. His intellectual attainments were of a high order and he was possessed of a very warm and capacious heart. Though he belonged to this earth, the vanities, the weaknesses and the littlenesses of this world could not touch him. His spirit always soared above the things of the earth and lived in communion with his Heavenly Father, while he devoted his physical body, his mind and his energies to the service of his fellow-brethren. His unselfish life, his devotion to duty, his inspiring teachings, his spotless character and his charming personality gained for him a very large number of disciples and friends to whom his death was a great personal loss. The two most marked features of his character were his absolute trust in the

Providence of God and his unbounded faith in the goodness of the human soul. He always took a hopeful and cheerful view of all things and he would never allow any unpromising circumstance to damp his spirit or influence his decision and this helped him a great deal in solving many a difficult problem in his dealings with men of contrary views and persuasions.

His activities were not confined to educational work only. From a humble worker in the Church of the New Dispensation (Brahmo Samaj), he rose to the position of a leader; and men even outside the Church once entertained the hope that in time the gap left by the death of the illustrious Keshub Chunder Sen would to a large extent be filled by him. The confidence he enjoyed of the members of his own religious community may be judged from the fact that he was elected as President of the All India Theistic Conference held at Lahore; and they also did him the honour by electing him as their representative on the World's Theistic Conference held at Geneva in 1909. He had thus the opportunity of travelling to Europe and America and of gaining first hand knowledge and experience of the various educational systems and modes of thinking prevailing in the Western countries and he was not slow to utilise them in respect of his work in India. Of men like him, the poet has truly said—

"Lives of great men all remind us,
We can make our lives sublime,
And departing, leave behind us
Foot-prints on the sands of time."

Prof. Benoyendranath Sen has left behind him his imperishable foot-prints and it is my earnest prayer that our young men should try their best to follow these marks as their best light and guide in the conduct of their lives.*

* The following is a quotation from a speech delivered by Dr. Bose at the B. N. Sen Memorial Meeting held at the Calcutta University Institute on the 4th August, 1913 :—

"I am sure the hearts of all of us present in this hall go out in sympathy to the members of the bereaved family. Who is there amongst us here whose sympathy does not go to the poor old broken-down mother of Prof. Sen, or to his broken-hearted widow, or to his loving and affectionate brothers and sisters or to the helpless innocent baby whom Prof. Sen has left behind him? When we consider how deep our sorrow has been at his untimely death, we can to some extent understand how intense their grief must have been and what a painful wound it has inflicted in their hearts. But if "sorrow shared is sorrow assuaged," it will be some consolation to the members of the bereaved family to know that their sorrow is shared not only by the whole student community of Calcutta, but by all who knew Prof. Sen. I had the pleasure and privilege of knowing Prof. Sen most intimately, both in private and public life. To me, he was an embodiment of all that is good, all that is noble, all that is pure and holy. Although he belonged to the earth, he was above all earthly contamination. The lower passions of the human heart had no hold upon his mind. His body was as pure as his soul. I never heard him speaking ill of a person; I believe he was incapable of even thinking unkindly or uncharitably of anybody. He was profoundly learned in certain branches of knowledge, but no one ever saw him making any demonstration of his learning; in fact, I very much doubt if he himself knew that he knew so much. His mission in life was to elevate other people; be they his students, or his wards of the Calcutta University Institute, or his colleagues, or the brethern of his Church, or even strangers, none failed to be elevated to higher planes of intellectuality and spirituality by associating with him. He was intensely spiritual and his faith in and love for God were unbounded. A man more resigned to the will of God I have seldom met with. On many occasions, I watched the bed of his mortal sickness and I never found one who bore his agonising sufferings with greater calmness, faith and fortitude. He was an ardent lover of Nature, and if at any time, he showed impatience in any matter, it was in regard to going out of Calcutta during his last illness to enjoy Nature in all her freedom and to feel the living presence of God in her beauties. He used to call his sick chamber as his prison-house, and he longed to be out of it. I may be permitted to quote a passage from a letter which I received from him from Giridih where he went for a change, which did him some good and raised hopes in the minds of his friends and relations, only a few months before his death, which shows his ardent love for Nature and his conception of the true purpose of life :—"So, I have had my flight at last.—out of darkness into light,—out of death into Life. The dismal night-mare is gone,—let me hope, vanished for ever! I never dreamed that Giridih was so bracing and so beautiful and charming! Or perhaps, every thing is beautiful and charming when the Divine Grace flows through it into our souls!"

"তোমাতে যখন, মজে আমার মন,
সকল ভুবন হয় সুধাময়"।

"Let me not trouble you with any details of the convalescent bed. The *process* through which even the rose blooms into life and beauty has had its thorns; not to speak of that through which a dead man comes back into life. Enough if the rose is there, let it be offered on the altar in the Temple! And so also, enough if the man comes back into life, let that life be offered on the altar in the Temple! Because it is no longer his, but belongs to Him Who has redeemed it!"—*EDITOR.*

The Science Association and its Founder*

There are many among the present workers and students of the Science Association (Indian Association for the Cultivation of Science) who do not personally know Dr. Mahendra Lal Sircar and who are not fully acquainted with the circumstances attending the foundation and the early history of this Association. At this session of the Science Convention, it will, I think, not be inappropriate if I give you a brief history of this Institution and a short sketch of the life and character of its great Founder.

The history of the Science Association is the history of a great ideal, somewhat in advance of the time, carried into practice by unfailing faith in a good cause supported by singleness of purpose, unflagging zeal, great personal sacrifice and whole-hearted devotion on the part of a single invidual endowed with a fertile brain, a high sense of duty and a lofty conception of patriotism.

In 1869, Dr. Mahendra Lal Sircar conceived the idea of establishing an institution, the object of which was "to invite, encourage

* Read at the Chemical Section of the Science Convention held at Calcutta in 1918 and published in its Proceedings.

Dr. Mahendra Lal Sircar C.I.E., M.D., D.L.

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and enable natives of India to cultivate Science in all its departments with a view to its advancement by original research and (as will necessarily follow) with a view to its varied application to the arts and comforts of life." It took six years for the project to mature. The time and circumstances were hardly favourable. There was little encouragement for the study of Physical Science in the local University. Most of the colleges were Arts colleges and the few that undertook to teach science were inadequately equipped for the purpose. The prospects of the graduates in Science were limited and the public mind generally was not prepared to recognise the importance or to appreciate the advantages of the study of Science. What little of the physical science was taught in the Presidency College, the St. Xavier's College, the Medical College and the Civil Engineering College benefited only a small number of students. Dr. Sircar had, therefore, to labour hard not only to prepare the soil but also to provide for an adequate supply of nourishment to the young plant for which he had to depend upon an unappreciative public.

Fortunately for him, he could get a few leading men and women of the time to support his cause. Some of them were great educationists ; others had distinguished themselves in public life or in one or other of the professions and a few were enlightened Indian

Chiefs and landlords. These men truly represented the intellectual and the social life of the people and were looked upon as the rightful leaders of the community. Among them may be mentioned the venerable Pundit Iswara Chandra Vidyasagar, Raja Rajendra Lala Mitra, Rai Kristo Das Pal Bahadur, Babu Joykisen Mookerjee, Maharaja Bahadur Sir Jatindra Mohan Tagore, Babu Kali Kissen Tagore, Raja Ramanath Tagore, Mr. Justice Dwarkanath Mitter, Raja Digumbur Mitter, Maharaja Kamal Krishna, the Maharaja of Benares, the Maharaja of Patiala, the Maharaja of Cooch-Behar, the Maharaja of Vizinagram, Maharani Swarnamoyee of Cossimbazar, Babu Sambhu Chandra Mookerjee, Babu (now Sir) Surendra Nath Banerjee, Rev. Father E. Lafont, Babu Kesab Chunder Sen and Babu Nilmony Mitter whose financial or moral support was of the greatest value to Dr. Mahendra Lal Sircar in giving the first start to the Science Association.

The scheme had also the official patronage and support of Sir Richard Temple than whom a more public-spirited and practical Lieutenant-Governor never sat on the *musnud* of Bengal.

When the plan had almost reached maturity, it had to pass through a severe crisis. A scheme for a technical institution was set on foot by the Indian League, a semipolitical organisation (now defunct), with the object of combining scientific instruction with practical

training, and drilling men in the arts which constitute the manual and mechanical industries. The scheme had also the sympathy of Sir Richard Temple. It was proposed that Dr. Sircar's scheme and the Indian League's project should be amalgamated and form a single institution where the teaching of science would be combined with instructions in the mechanical arts which would open new ways of living for the people of the country. Dr. Mahendra Lal Sircar and many of his colleagues were opposed to this idea. The proposal of the League, as Father Lafont (one of the most eminent colleagues of Dr. Sircar) contended, was to transform the Indians into a number of mechanics requiring for ever European supervision, whereas Dr. Sircar's object was to emancipate, in the long run, his countrymen from this humiliating bondage. He further observed that the avowed object of Dr. Sircar's Association was to teach the principles of modern science to the people of India without which the teaching of the practice and applications of science would be like putting the cart before the horse. Dr. Sircar's idea was to confine the work of his institution to the teaching of pure science and research-work which, he thought, in the ordinary course, would lead to the development of the arts and industries of this country. After a good deal of controversy in the papers and animated discussion at a joint meeting of the organisers

of the Science Association and the members of the Indian League held at the Senate House under the presidency of Sir Richard Temple, the Lieutenant-Governor after taking the sense of the meeting declared that the two schemes could not be amalgamated and they were allowed to have separate existence.

The Government of Bengal acquired the present site with some old buildings situated thereon at a cost of Rs. 50,000 and made it over to the Committee of Management temporarily on certain conditions which were duly fulfilled. The inaugural meeting of the Association was held at the new premises on the 29th July, 1876, and the work of the Association practically began from that date. The Association owes an immense debt of gratitude to the Government of Bengal for this timely assistance, but for which it could not have commenced its work so early.

It soon became apparent, however, in the words of Sir Ashley Eden, that "the connection with Government was rather a disadvantage to the institution than a benefit." So long as the building belonged to Government, the Association was unable to build such an extension of the premises as they required. The Government kindly agreed to accept Rs. 30,000 for the old house and land which was accordingly paid by the Committee of Management and the property became absolute for the Association. This is one of the many instances of the

sturdy independence which marked the character of Dr. Mohendra Lal Sircar, and his name and memory will for ever be remembered for having worked so assiduously to keep the principle of independence in tact in the constitution of the Science Association.

Lord Lytton, the then Viceroy and Governor-General of India, was pleased to pay a visit to the Association in March, 1880, and listened to an illuminating lecture by the Founder of the Association on the "Ultra-gaseous State of Matter." Lord Lytton entertained great hopes for the future of the Association which found expression in the following eloquent and prophetic words of His Excellency spoken with reference to the work of Dr. Mahendra Lal Sircar and his little band of faithful allies :—

"Of those who have thus far supported this institution I say that theirs, and theirs exclusively, is the honour due to the rapid growth and achievement of this most promising offspring of their individual wisdom and social activity. They it is who are the parents of the future conquerors and greatest benefactors of India. It is they who here, in this province of Bengal, have enlisted and are enlisting native thought, native research, native industry and hope, and above all, native knowledge in the ranks of that band—that little band it may be now, but which is destined year by year, more and more, further and further, to carry through the length and breadth of India the

ever widening light of the practical truths which belong to Science."

The first lecturers of the Association were Dr. Mahendra Lal Sircar and Rev. Father E. Lafont in Physics, Rai Tara Prasanna Roy Bahadur in Chemistry and Rev. A. de Penaranda in Astronomy. It is a pleasure to me to reflect that the Chemistry Department of the Calcutta Medical College has materially contributed to the teaching work of the Association from its very birth. Rai Tara Prasanna Roy Bahadur was my predecessor in office and he joined the Association as a Lecturer of Chemistry in 1878. He was succeeded by Babu Ram Chandra Dutt on whose death in 1888, I was offered the Lecturership by Dr. Mahendra Lal Sircar and for the last 20 years, I have been serving the institution as Lecturer in Chemistry. The Association had the honour of enlisting the services as lecturers in various scientific subjects of such distinguished scholars and educationists as Sir Ashutosh Mookerjee, Sir Jagadish Chandra Bose Mr. Mahendra Nath Ray, Mr. Shyama Das Mookerjee, Sir Nil Ratan Sircar, Principal G. C. Bose, Dr. Banwari Lal Choudhuri and many others. Successive Lieutenant-Governors of the province very kindly accepted the Presidentship of the Association which enjoyed their confidence, sympthy and active co-operation. The Association, thus boldly conceived and skil-

fully organised, was ably conducted by the Founder-Secretary with the help of a Committee of Management until the day of his death which took place on the 23rd February, 1904.

It was my proud privilege not only to know Dr. Mahendra Lal Sircar but also to sit at his feet as his pupil in the Physics class and afterwards to be associated with him in the teaching work of the Association. Physics was not taught as a separate branch of science in our student days in the Medical College. I joined the Science Association in the early eighties of the last century and profited greatly by the lucid lectures of Dr. Sircar and Father Lafont on Heat, Light, Electricity and Magnetism.

The year I joined the Association as a lecturer, I approached Dr. Sircar with a scheme for the institution of a Commercial Analysis Class where our young men could be taught analysis of water, foods, drugs, mineral and commercial products, which would enable them to start life either as independent analysts or obtain employment as chemists in commercial or industrial firms. Dr. Sircar gave the scheme a warm welcome and had it adopted by the Managing Committee. It was a two years' course after passing the Matriculation examination based on a solid groundwork in Physics, Botany and Chemistry, theoretical and practical, with a special course of training in commercial chemical analysis. A good many youngmen

have gone out of this class and are now engaged in practical analytical work.

My friend, Dr. B. L. Chaudhuri, informs me that it may not be known to many people that Dr. Mahendra Lal Sircar originally had no intention to study medicine. He was a brilliant student of the Presidency College and his favourite subject was Psychology. There are a great many problems involved in the study of Psychology, which cannot be well understood without a knowledge of Biology. He did not get satisfactory explanation of many such points from his professors. He, therefore, decided to join the Medical College to study for himself the science of Biology in which he ever afterwards took a deep interest and for the study of which, he soon opened a section in the Science Association. This shows what an earnest and devoted student he was, always trying to go to the bottom of everything to find out the truth. This was a turning point in Dr. Sircar's life which transformed an ardent student of Arts into a distinguished physician and a great scientist.

The great ambition of Dr. Mahendra Lal Sircar was to see the Science Association grow and prosper into an institution where his own countrymen, after finishing their University education would, on their own account, conduct original research work in the different branches of Science. This ambition, thanks be to God, has at last come to be realised, though it is a

matter for deep regret that Dr. Sircar did not live to see its fulfilment. During the past few years, research work of great merit and importance has been and is being carried on in the Association by Dr. Sircar's countrymen, Bengalis and Madrasis alike, which has helped to place the Association in the rank of the great Research Institutions of the World and which, it is hoped, in course of time, would restore India to her former position as a teacher of the world. When the history of science-teaching in India is written, Dr. Mahendra Lal Sircar's name will be inscribed therein in letters of gold as the pioneer of this national regenerating movement.

In these days of *Swadeshi* movement and Self-government, Dr. Mahendra Lal Sircar's life-work has a special significance. When the Science Association was started, *Swadeshi* movement in its militant form was unknown. Yet if you look at the prospectus of the Science Association, you will see there recorded in black and white that the intention of the Founder in starting the Association was "to enable the indigenous intellect, in noble rivalry with the intellect of the West, to assert its rightful sovereignty over the domains of Nature," and that the management and control of the Association should be vested in the hands of the natives of India. Dr. Mahendra Lal Sircar was thus a true *Swadeshi* and a true patriot, and if we had a few more patriots like him, the

cause of the true *swadeshi* and Self-government would have, by this time, materially advanced.

Born of humble origin, he rose to a pre-eminently high position in the public life of Bengal. He was the first man and the leader of his profession in his own line during his life-time, was one of the most influential and active members of the Senate and the Syndicate of the Calcutta University and was the President of the Faculty of Arts for many years. He was a Municipal Commissioner for the town of Calcutta, an Honourary Presidency Magistrate, a member of the local Legislative Council, and for a time, held the high office of the Sheriff of Calcutta. He received the highest degree in Medicine of the Calcutta University, and the honourary degree of Doctor of Law was also conferred upon him in 1898 by Lord Curzon as the Chancellor of the University. He was made a Companion of the Exalted Order of the Indian Empire in 1883 in recognition of his services to the cause of Science. He was a member of Council of the Asiatic Society of Bengal and was one of the Trustees of the Indian Museum. As regards foreign honours, he was a Life Member of the British Association for the Advancement of Science, a Life Member of the Astronomical Society of France, and a Corresponding Member of the American Institute of Homœopathy and of the British Homœopathic Society. His life is a living example before his countrymen

how a person of humble origin by sheer force of education, character, industry and honesty of purpose can rise to the highest pinnacle of fame and be the happy recipient of high honours, civic and academic.

There are a few traits in the character of Dr. Mahendra Lal Sircar which his countrymen would do well to imitate. His great love and fearless advocacy of truth elicited admiration and respect from all who came into contact with him. He hated nothing so much as falsehood in any form, direct or indirect, and he could never put up with any evasive or prevaricated statement. He never spared even his most intimate friends in this matter and spoke out his mind freely and in language which sometimes produced not very pleasant results. In the matter of out-spoken criticism, few could be found to compare with him. It sometimes caused breach in long-standing friendship but it was ultimately made up as soon as the offended person came to a right understanding of the spirit in which it was spoken. Out-spokenness was pre-eminently a quality of his character which his countrymen would do well to cultivate.

How he clung to truth in every detail of life, the following incident will illustrate. The private tutor of one of his grandsons took the boy to a school for admission and understated his age by six months. Dr. Sircar accidentally came to know of this; he severely

reprimanded the private tutor, saying that he was unworthy of his vocation as a teacher, having begun his work by teaching an untruth to the boy, and made him go back to the school and had the entry corrected. Parents and guardians who rush to make affidavits in respect of the age of their wards at the time of the Matriculation Examination would do well to take a note of this.

In purity of character and in simplicity of manners and habits, he was like a child and he lived and died as such. His private and public life could bear the strongest search-light of scrutiny, and his simplicity in dress, in food and in other habits of life was exemplary.

Although a man of a somewhat stern exterior, his heart was full of the milk of human kindness. At what sacrifice and with what kindness did he not attend the numberless patients coming to his house every day for the benefit of his advice and treatment! He did not only treat them without charge but gave them medicines free and would often help the needy among them with cash to provide for invalid diet. In later life, he raised his professional fee to Rs. 100 for visiting rich people at their houses, with the determined object of getting more time at his hands that he could devote to the treatment of the poor people who visited him in his own house. The wonder was that even by this arrangement, his income did

not suffer, although the number of his calls was reduced.

His philanthropy found expression in the establishment of the Rajkumari Leper Asylum at Baidyanath in 1893, named after his dearly-beloved wife. During his occassional visits to that health resort, he was struck with the number of men in that place who suffered from that cruel disease, their neglected and helpless condition and their physical sufferings. It melted his heart but he was not a man to remain content by showing passive sympathy only. He set up to work at once and with his personal donation of Rs. 5,000, supplemented by public subscriptions, he created and endowed a Home for the shelter and treatment of the unfortunate victims of that disease and this institution has since been doing much useful and humanitarian work in that part of the country.

He was bitterly opposed to all kinds of tyranny, social, spiritual or political. The claims and privileges of any particular class or caste found no favour with him and he spared no pains, in his writings and in his speeches, to make clear his views in the matter. He stood always for truth and reason, and had little sympathy with the despotism of traditional opinions and harmful, though time-honoured, social usages and customs. He gave his unqualified support to the raising of the marriageable age of boys and girls in

the Brahmo Marriage Act inaugurated by Babu Kesub Chunder Sen and was one of the staunchest supporters of the Age of Consent Bill. These views, publicly expressed, created a strong agitation against him in some of the orthodox Hindu papers in Calcutta, but this could not make him change his views.

In religion, he was a monotheist and his utterances and writings give ample proof of his deep love for his Creator, his unshaken faith in His Dispensation and thorough resignation to His Will. He saw God in Nature and Nature in God. He deprecated image-worship and man-worship which are the two predominating features of popular Hinduism, but he entertained unbounded reverence for saintly men. He had high respect for the character and teachings of Ram Krishna Paramahansa, the sage of Dakshineswar, whom he treated medically in his last illness and with whom he spent long hours listening to his divine and simple teaching of spiritual and moral truths, although he used to quarrel with the disciples of the sage when they offered him homages as an incarnation of God.

Courage of conviction was another predominant feature in Dr. Sircar's character. He was a distinguished graduate of the Calcutta Medical College and a successful practitioner of the allopathic system of medicine. As a member of the British Medical Association in his early days, he gave a public address strongly

denouncing Homœopathy as a system of Medicine. But as soon as he became convinced of the truth of the principles of Homœopathy, he did not lose a day to become a convert to that system at the risk of great uncertainty as regards future prospects and in face of great opposition and persecution at the hands of his brother allopathic practitioners. Undaunted by opposition and regardless of the consequences, he stuck to the new system because he believed in it, and future events show that he was not wrong in his choice so far as success in his profession and worldly prospects were concerned.

When in 1895, the scheme for an All India Pasteur Institute for the treatment of dog-bite cases was completed and Provincial Committees were formed to educate public opinion in the aims and objects of the institution and to collect subscriptions for the purpose, Sir Robert Harvey (who was then the Inspector-General of Civil Hospitals in Bengal) was appointed as the Secretary of the Bengal Committee and I was one of the Assistant Secretaries. I was asked by Sir Robert to see Dr. Mahendra Lal Sircar and to enlist his sympathy in the movement. A public meeting in support of the movement was held at the Town Hall under the presidency of Sir Charles Elliott, the then Lieutenant-Governor of Bengal. I approached Dr. Sircar and requested him to speak at the meeting.

He took a few minutes to consider the matter, as the movement originated from the orthodox section of the medical profession which he had long ago renounced, and then smilingly expressed his willingness to speak at the meeting in support of the movemont, because, he said, the treatment of Rabies by Pasteur's method was a vindication of the principle of Homœopathy, *e.g.*, curing Rabies by attenuated doses of the virus of the disease.

He was a profound scholar and his command over the English language, both as a writer and speaker, was of a superior order. He was not only deeply read in his professional subject, but his knowledge in the different branches of physical science and in biology was of a high order, and his study of general literature was extensive. Few men of his time possessed such a big library as he had, and he spent a large portion of his income in the purchase of books of rare value in all branches of learning, science, medicine and literature, and he made good use of this valuable collection. He was a most eloquent, incisive and forceful speaker; and this had stood him in good stead in respect of the collection of funds for the Science Association.

He was one of the organisers of the Society for the Higher Training of Youngmen founded by the late Rev. Pratap Chandra Majoomdar and which is now known as the Calcutta University Institute. In connection with the

founding of this institution, he delivered a most interesting and instructive address before a large assembly of young men on the "Moral Value of Scientific Studies" which was highly appreciated by the public.

Dr. Sircar started the Calcutta Journal of Medicine in 1868 and conducted it almost single-handed up to the day of his death. It demanded much sacrifice of money and time which he ungrudgingly gave amdist his professional and multifarious public duties. In a country like Bengal where everything is short-lived and the fire of enthusiasm in a good cause blazes up studdenly and dies out as quickly, the regular conduct of a scientific journal for over a period of 36 years speaks volumes for the ability, resourcefulness, energy, determination and perseverence on the part of the Editor, and these are qualities well worth imitation by his countrymen.

Such was in brief the life and character of Dr. Mahendra Lal Sircar who, for about 40 years, shone as a bright luminary in the intellectual firmament of Bengal and who devoted the energies of the best portion of his life towards the foundation and maintenance of an institution which will for ever be of benefit to his countrymen in their onward path of progress.

I conclude this brief history of the institution and the short sketch of the life and character of its illustrious Founder by quoting the following lines from his last appeal to

his countrymen, soliciting their help and co-operation in the maintenance and development of the Science Association :—

"To you, my dear Colleagues, from whom I received the heartiest sympathy and support, and to all our educated young men who have not yet come forward as they should have, I leave this Science Association of ours as a legacy which, calculated to regenerate our country, you will, I dare say, try your best to improve and develop to its utmost capacity."

Let us fervently pray to God that his last wishes be fulfilled.

The signs of the time are hopeful. The tiny seed which the Founder sowed in rather an uncongenial soil has grown into an adult tree and has begun to yield sweet and nourishing fruits. The Science Association has been able to found *research medals* and *research scholarships*, to organise *quarterly scientific meetings* for the reading of original communications in various branches of Science, and to regularly issue *bulletins* which have been appreciated in quarters best able to judge of their merits. It has been able to secure a number of ardent, enthusistic and self-sacrificing *research students* whose work has stood the test of the Western scientific crucible and pronounced to be unalloyed gold. Further, it has been able to organise this *Science Convention* whose second anniversary we have gathered here to celebrate to-night. But while something has been

accomplished, *much yet remains to be done.* And so long as that remains unaccomplished, the spirit of the great Founder which has not left the scene of his labours, will not be satisfied. We need *Endowments of Professorships* in the different branches of Science, without which the object and the work of the Association will remain incomplete. Is it too much to ask of the many public-spirited wealthy fellow-countrymen of Dr. Mahendra Lal Sircar to come forward with generous contributions to fulfil the last wishes of the great man who dedicated his whole life to his country's and his countrymen's service ?

Pandit Sivanath Sastri As I Knew Him.*

My acquaintance with Pandit Sivanath Sastri began in 1874 or 1875 when I was 14 years old and was a student of the 3rd class in an Entrance School. The late Mr. Ananda Mohan Bose had then just returned from England. He was the first Bengali Wrangler and his countrymen naturally felt very proud of his distinguished career in England and his brilliant success in the Examination. Pandit Sivanath Sastri arranged for a meeting at the garden house of Raja Rammohun Roy in Amherst Street to accord to his friend a hearty welcome on his return to India. I was in the habit of attending public meetings from a very early age and I have not been able, even in my old age, to give it up. I felt a great desire to see Ananda Mohun Bose and I managed to be present at the reception. Pandit Sivanath Sastri was rather surprised to find a boy of my age attending the meeting but he seemed to be very pleased, took me by the hand to Mr. Ananda Mohan Bose and pointing him out, said to me with a smile, —"from this early age, you try to follow in his footsteps and become as great as he is." That was my first acquaintance with Pandit Sivanath Sastri. Before that, I knew him by name only and greatly respected him. I knew him also by his writing, for when I was a boy of 8 or 9,

* The Indian Messenger, October 12, 1919.

we used to read a vernacular Poetical Reader (Padya Patha) by Jadugopal Chatterjee which contained a charming piece of poem entitled নির্বাসিতের বিলাপ (Lamentations of an Exile) by Pandit Sivanath Sastri which, in pathos and poetical excellence, is still considered to be of very high merit.

In 1877, when I was a Matriculation student, we organised a literary society called the "Bhratri Sammilani Sabha" composed of a small number of school and college boys, and at the meetings of the society, papers were read and lectures were delivered in Bengali. I was entrusted with the duty of approaching Pandit Sivanath Sastri to request him to address the first anniversary of the society. Although I was then only 16 years old and a mere school boy, I received a very kind and warm welcome from the Pandit. He encouraged me by expressing sympathy with the object of our society and kindly accepted our invitation and promised to deliver an address on *Education* at our annual meeting. The late Rev. K. M. Banerjee presided. I still remember some of the words of wisdom that Pandit Sivanath Sastri spoke in the course of his address. He said that any system of education that failed to build up character was not worth having, that real education consisted not in the acquisition of knowledge but in the formation of character, and that the moral and spiritual sides of education should always be thoroughly cultivated. We were struck by his

wonderful eloquence and by the learned character of his address and we felt very grateful to him for his wise words which made a deep impression on our young minds.

Then I knew him again and in the full manifestation of all that was best and noblest in him at the time when he with many of his friends seceded from the leadership of Keshub Chunder Sen and established the new Church known as the Sadharan Brahmo Samaj. I was present at the meeting held in 1878 in the house of the late Babu Upendra Nath Bose in Machuabazar street when the action of Babu Keshub Chunder Sen in connection with the Cooch-Behar marriage was mercilessly, but with (what appeared to me) unanswerable arguments, criticised by Pandit Sivanath Sastri, Nagendranath Chatterji and others belonging to the protesting camp. At this meeting, the final separation of the two parties was effected. The absolute regard for truth, deep loyalty to principle, courage of conviction, strength of purpose and the intense religious fervour displayed by Pandit Sivanath Sastri and his friends at this great crisis in the history of the Brahmo Samaj of India will never be forgotten by those who had the privilege to witness it, and it created such a favourable impression on the public mind that communities other than the Brahmo community took up in right earnest the cause of the seceders and helped to advance it. Pandit Sivanath Sastri with one or two of

his enthusiastic friends was entrusted with the duty of collecting funds for the construction of a new temple of worship and with other matters in connection with it. Maharsi Debendranath Tagore paid to Pandit Sivanath the princely donation of Rs. 7000 for the purpose and this was, I believe, the largest contribution towards the construction of the Sadharan Brahmo Samaj Mandir located at 211, Cornwallis Street. I shall never forget the enthusiasm and joy displayed by the small but devoted band of Brahmo men and women on getting at last a permanent place of worship which they could call their own and it melted my heart to see tears of joy flowing down their cheeks when, on the opening day of the Mandir, they sent up their fervent prayers breathing love and deep gratitude to God for His grace and His mercy. The scene left a deep impression on my young mind which I shall remember with pleasure and profit to the last day of my life. Although I do not belong to the Brahmo community, during my student life and for many years afterwards, I was a frequent attendant of the Sunday Service at the Sadharan Brahmo Samaj and my chief attraction had been the eloquent and touching sermons of Pundit Sivanath Sastri which used to appeal to my heart more deeply than any thing I have ever heard or read, and those visits greatly helped to improve my early acquaintance with this great and gifted teacher.

The Hon'ble Mr. Justice J. G. Woodroffe*.

(An Appreciation)

We have heard with great regret that Sir John Woodroffe is soon going to retire from the High Court Bench and leave India for good. It is needless to say that the news has caused great distress to us, and we have met here this evening, under the auspices of the *Vivekananda Society*, to give expression to our regret and to record our sense of the loss our country will suffer by his retirement.

Sir John Woodroffe occupies a high place in the affection, gratitude and esteem of the people of Bengal. His valuable services as an able, experienced and conscientious Judge are greatly appreciated by the Bench, the Bar and the general public, and his retirement is rightly looked upon as a great public loss. Bengal has intimately known his family for three generations. His maternal grandfather was a Magistrate of Calcutta in the early forties of the nineteenth century.

* Presidential address delivered at a meeting of the *Vivekananda Society* held at the Bangiya Sahitya Parishad Hall on the 11th August, 1922, when a farewell address was presented to Sir John Woodroffe.

The Calcutta Review, Octebor, 1922.

His revered father's able and eminent services as the leader of the Calcutta Bar, his high character and his wide sympathy for his Indian fellow-subjects are to this day remembered with pride, admiration and gratitude. Even in the early part of his career as an Advocate of the Calcutta High Court, Sir John raised great expectations of proving to be a worthy successor of his distinguished father but events took a different turn and he left the Bar for the Bench. His appointment as a Judge of the High Court gave great satisfaction to all sections of the community and it proved to be a very happy selection.

In the interest of scholarship and culture, his elevation to the Bench may be considered to be providential. For had he remained engaged in the busy practice of his profession, it is very doubtful if he could have found time to devote himself to the study of some of the abstruse problems of life promulgated by the religion of ancient India and her philosophy. The results of his profound scholarship and deep study have immensely enriched the store of human knowledge and has secured for him a place in the front rank of the oriental scholars of the day. A more earnest, a more diligent, a more devoted and a more sympathetic student of the Hindu Religion, Hindu Philosophy and Hindu Culture can seldom be found among Europeans, in India or abroad, at the present moment. He

has studied the whole subject with a mind free from racial, political and religious bias and has approached it with a single-minded determination to search after truth. All his writings, while permeated by a broad and intelligent sympathy for the Indian type of Culture, are inspired by a sense of strict regard for truth and by an intense desire to do justice to the subject. Sir John Woodroffe is an ardent admirer of Indian Civilisation and Indian Culture, and the appearance of his books on the subject, *viz.*, "*Is India Civilised ?*" and the "*Bharata Shakti*," at the present moment is most opportune, as it will help to concentrate the attention of educated India to what rightly belongs to them by precious heritage and what tney are in duty bound to save from the disintegrating influences of an alien Culture. It is a matter for sincere congratulation that the University of Calcutta is at present doing its level best, commensurate with the resources at its disposal, to encourage and facilitate study and research in Indian History, Indian Civilisation and Indian Culture, and already a good deal of spade-work has been done in this very important but long-neglected branch of human knowledge.

Sir John Woodroffe has incurred the displeasure of some of his own countrymen for his vigorous defence of Indian Culture and his condemnation of the harmful aspects

of the Western Civilisation and Western Culture. One who cares for truth only, need pay no attention to such unfair criticisms which are more or less prompted by religious prejudice, racial vanity or political motive. India will ever remain grateful to him for his bold, illuminating and scholarly exposition of the fundamental principles underlying Hindu Civilisation and Hindu Culture and for his earnest appeal to our countrymen to defend them against defilement and disintegration. Let me quote here his own forceful and inspiring words ;—

"It is for the Indian people to say where they will go. What I urge is that the Indian spirit should be *itself* and thus have *cultural freedom.* When it has regained this by study and appreciation of its own inherited ancient and grand culture and by the casting away of all unassimilated foreign borrowings, it may go where it will. I have confidence that in such case, its way will be the right way—that is an Indian way. The inherited ideas and instincts (*Sanskaras*) of thousands of years will assert themselves. In any case, I believe that Indian Culture has value and that its ideas, if spread, will have a beneficial effect on men at large."

Sir John Woodroffe is, however, not blind to the faults and corruptions of the present Hindu society and he condemns them with all the vehemence and earnestness of a moral

teacher and a true friend. In his defence of the Indian Civilisation, he has nowhere said that the West is entirely materialistic, that every Indian is a phenomenon of spirituality or that there is nothing in the occidental civilisation which cannot with advantage be absorbed and assimilated by the Indian type. He fully recognises the fact that the present Hindu society is thoroughly permeated with materialism. What he has tried to prove in his writings is that the character of Indian Civilisation is distinctly and predominantly religious and that regeneration of India should proceed on truly Indian lines and must spring out of the *seed* which has produced the Indian race. Every right-thinking man having the interest of India in his heart, will agree with Sir John Woodroffe in his well-reasoned conclusion.

For a great many years, he has been assiduously applying his leisure hours to the study of Hindu scriptures, specially the *Tantra Shastra*, and his essays and addresses constituting the volume known as "*Shakti and Shakta*," are valuable contributions to the literature on the subject. By writing this book, he has done a very great service to India by creating an interest among educated Indians in the study of this neglected and generally much-despised Hindu form of worship. *Tantra* for centuries exercised a

predominant influence on the social and religious life of the people but it was put to such great abuse by the ignorant followers of the cult that the word *Tantra* became synonymous with sorcery and all kinds of moral depravity practised under the garb of religion. *Tantra* became a proscribed literature in the higher strata of the Hindu society and its followers were despised and shunned. Sir John Woodroffe by his erudite and lucid exposition of the philosophy of the *Tantra Shastra* and by his rational interpretation of the various rituals practised under the system, has been successful in removing to some extent the odium attached to the name of *Tantra* and softening the prejudice entertained by educated Indians against it.

Sir John Woodroffe has done another great service to India. India is chiefly an agricultural country and cattle is the principal wealth of her people. Indians live principally on milk and its products. The well-being of the cattle-life in India is, therefore, intimately connected with the health and prosperity of the people. Sir John Woodroffe as President of the All-India Cow Conference Association (which has its head-quarters in Calcutta), has helped much to stimulate the activities of the people in the matter of protection, preservation and improvement of cattle-life in India. A great deal of propaganda work is being done by this Association and its branches, in con-

sequence of which slaughter of cattle in some places has been stopped and better care of cattle-life is being taken by the people. Dairies are also being organised for supply of pure milk. His connection with this Association has proved to be a great impetus to the movement for the protection and improvemont of cattle-life in India and his retirement will be a great loss to this good cause.

We, the members of the Vivekananda Society, are under a deep debt of gratitude to Sir John Woodroffe for the keen and kind interest he has always taken in its affairs. A few years ago, he honoured the Society by delivering a series of seven lectures on the Philosophy and Practice of *Shakti Worship* which were finally embodied in his great book on "*Shakti* and *Shakta*." He is a great admirer of Swami Vivekananda and he wishes to see that the life and teachings of that great man are widely read and emulated by the young men of Bengal. At one of the annual meetings of the Society, Sir John Woodroffe was good enough to read a paper on the *Philosophy of the Tantras*, and at another annual meeting, he did us the honour to preside over it. He has very kindly and generously presented his valuable works to the Society as well as the voluminous *Tantric* texts with their translation and commentaries published by him under the *nom-de-plume* of Arthur Avalon. We take this opportunity to offer our heartfelt

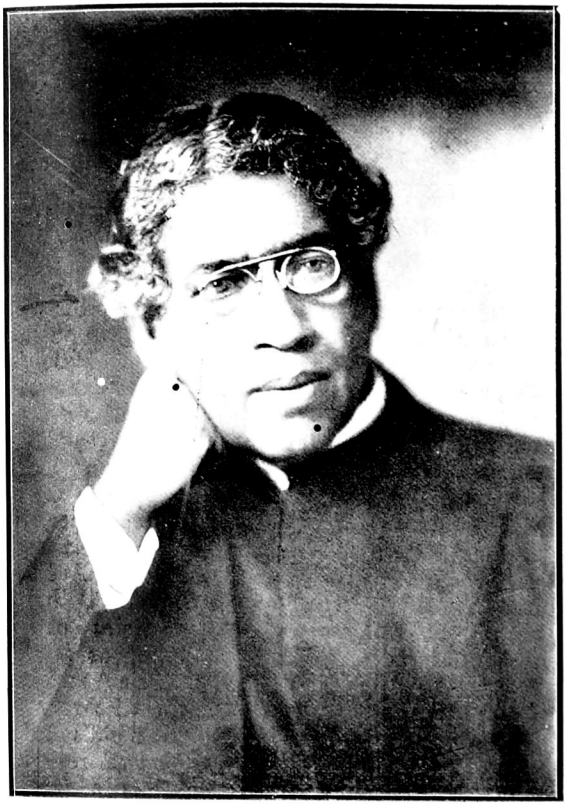
thanks to Sir John Woodroffe for the many acts of kindness done by him to the Society.

In conclusion, we fervently pray to God that his life may be spared long and be spent in the service of England which is his *Janma-Bhumi* (Land of Birth), and of India which has been his *Karma-Bhumi* (Land of Labour) for over 33 years. May he enjoy peace, happiness and health in his well-earned retirement.

Sir Jagadis Bose and His Discoveries *

Faraday and Maxwell were the first to declare that Light is an electro-magnetic phenomenon. This led to the discovery of electric waves by Hertz, which showed some of the properties of light. But these waves were about 10 million times longer than the beams of visible light. Professor Bose has thrown a bridge over this gulf by discovering and studying electric waves about six millimeters long, the longest heat waves known at present are about $\frac{1}{10}$th of this length, *viz.*, 0·6 millimeter. These shortest electric waves of Dr. Bose showed all the properties of visible light. He also discovered the polarisation of electric waves by rocks and crystals. Before his discovery, it was assumed that, by the action of electric waves, particles of two metallic pieces in contact, were, as it were, fused together, so that their resistance diminished. But Prof. Bose's discovery of increasing resistance in some metals led to a new theory that the variation of resistance produced by electric waves, is a function of molecular and atomic structure. In order

* The Calcutta Medical Journal, May, 1917.



Sir Jagadis Bose, K. C. S. I., C. I. E., F. R. S., D. Sc.

To face page four.

to produce the shortest electric oscillations and yet having sufficient energy to be detected and to study their properties, Dr. Bose constructed radiators of his own type and has enriched Physics by a number of new apparatus and instruments, distinguished for their simplicity, directness and ingenuity.

These electric waves, known as Hertzian waves, are used for Wireless Telegraphy which is one of the greatest achievements of Physical science. Dr. Bose's discoveries have been utilised in constructing some of the important parts of wireless telegraphic instruments ; in fact, one of the most efficient Receivers now in use (Galena Crystal Detector) is Dr. Bose's invention. The leading Electrical Journal pointed out at the time that no secret had at any time been made as to the construction of Prof. Bose's apparatus, so that it has been open to all the world to adopt it for practical and money-making purposes.

Sir Oliver Lodge invented the first instrument called the Coherer, for the detection of the existence of the Hertzian waves. It was, however, soon found that the receiving instrument refused to respond to the action of the waves after a certain time, and that they regained sensitiveness after resting a while. This puzzled the inventor and other great physicists of that time and they could give no explanation for this peculiar behaviour of the metal particles. Sir Jagadis very

closely investigated the matter and it was he who first proved the hitherto undreamt-of phenomenon, viz., that this inaction was due to the fatigue of the metallic particles and their consequent inability to respond for the time being to stimulus, exactly what takes place in the case of living tissues after continued stimulation. These particles recovered their former sensitiveness after rest.

This memorable discovery led Sir Jagadis to continue his researches on the action of various stimuli on so-called inanimate matter, confining himself chiefly to metals. It was known long before, that an electric current was generated in living tissues when these were subjected to the action of stimuli, which could be detected by means of a delicate galvanometer but dead animal tissues showed no such result. It was Sir Jagadis who first discovered that the so-called inanimate matter such as metals etc., reacted in the same way on the application of stimuli; they respond to stimulus, and continued stimulation brings on fatigue in them as seen in living animal-tissues.

Not only this, but he also discovered the remarkable similarity between organic and inorganic matters in their response to the action of temperature and drugs.

Response to stimulus had hitherto been accepted as the correct definition of life and

recognised as the specific property of living organisms. It was Sir Jagadis who first enlightened the world, by most accurate experimental demonstrations, that the so-called inanimate matter was also endowed with sensitiveness akin to living things.

Sir Jagadis did not rest here. Following his wonderful discovery of the action of stimuli on metals, he next carried his investigation on plants and found to his surprise that they also showed the same phenomena under stimuli to a degree beyond expectation, just as animals do. The instruments, then in use for recording plant-movements, were too crude to suit his delicate experiments and he constructed a series of marvellous instruments one of which is the Resonant Recorder, by which he could easily record the most delicate movements of the plants under the application of stimuli and depressants. He found that plants were affected as much as animals are by variations of temperature, by electric and mechanical shock and by the application of drugs, anæsthetics and poisons; they could be intoxicated by alcohol, made insensible by chloroform and killed by the application of heat and poisons. Further, after they were depressed, they could be revived by proper restoratives in the same way as animals.

His next epoch-making discovery was, that plants possessed a highly developed nervous system as possessed by higher animals. This

was denied to the plant-world, and even such distinguished scientists as Pfeffer and Haberlandt maintained that the response to stimuli by plants was accountable, not by their possessing a nervous system but that it was due to the action of difference of pressure in the water present in the tubal canals of the plants, and they at first opposed the theory that the stimuli acted directly on the nervous system of plants as maintained by Dr. Bose. This discovery of Dr. Bose produced a phenomenal sensation in the scientific circles of Europe and America. Sir Jagadis during his last tour round the world demonstrated the existence of the nervous system in the plants beyond all controversy in the presence of a gallaxy of scientific men at the Royal Society in London, before the Universities of Cambridge and Oxford, Paris, Vienna, and Berlin. He also gave demonstrations of his discoveries before all the important Universities in the United States and in Japan, and he proved that there was no fundamental difference between animals and plants as regards phenomena of life, and that the difference between the plants and animals as regards their physiological functions was a difference in degree only but not in kind.

The scientific world has now accepted Dr. Bose's findings. Proceeding with his investigations, Sir Jagadis has also shown, that certain plants such as the "Ban-Chanrhal" (*Desmodium Gyrans*) shows automatic pulsation like the

heart-beat of an animal, independent of external stimulus. He has also proved that the heart-beat of the tree maintains its circulation as the heart-beat of the animal maintains the circulation of blood. He has also found that the death of plants is attended with a death-spasm corresponding to the *death throe* of the animal.

The last, though not the least, of his wonderful achievements in the domain of Science is the invention of an instrument, called the Crescograph, by means of which he could record the growth of plants taking place, not in months and years, but in the incredible short period of a single second only.

Apart from the inestimable value of these discoveries from a purely scientific point of view, they are full of potentialities and may prove to be of great practical application in Agriculture and in Medicine. If you can record the growth of plants under different surroundings as quickly as Dr. Bose's instrument enables you to do, the effect of different kinds of manures on the growth of plants could be demonstrated in a few minutes instead of in years to the greatest advantage of the cultivators and farmers. Then again, we have hitherto confined ourselves to making experiments on animals to demonstrate the physiological action of drugs and poisons. Dr. Bose has opened a new field for us and it may be profitably utilised within proper limits. His discovery of the Molecular Cycle has explained the ano-

maly of antagonistic effect of the same drug on different individuals. The import of his discoveries in the field of Practical Medicine and their appreciation have been unique. During his recent visit to the West, the Royal Society of Medicine of Great Britain, the most conservative medical body, invited him to give them a discourse, the only other outsider who was allowed to address the Society was Prof. Metchnikoff. And the Secretary of the Society worte to the Home Government that the discourse of Prof. Bose was one of the most successful and instructive they had since the foundation of the Institution.

These epoch-making discoveries have secured for Dr. Bose a world-wide reputation. Although we do ourselves great honour by claiming him as one of our countrymen, a Bengali, he is not a Bengali in the widest sense of the term. Even he is not an Indian. His native place is not bounded by any geographical limit. He belongs to the whole world, as he is the benefactor of the whole human race. The dedication of the earnings of a whole life for founding the Bose Research Institute in this city, where earnest students of Science from all parts of the world might come and carry on original investigations, is a legacy which Dr. Bose is leaving not to India alone but to the whole world, for the advancement of Science,

and this alone would justify his claim to be called a citizen of the world. We owe Sir Jagadis Bose a deep debt of gratitude for once more raising India in the estimation of the whole world and proving that the world's advance in Science would be incomplete without India's active co-operation. He has inspired us with the living hope that we shall be able by our united efforts to build a greater India yet to be.

POPULAR SCIENTIFIC LECTURES

A Lump of Coal *

I. General Observations.

A lump of coal, unattractive but very useful.

I hold a lump of coal in my hand. It is an unsightly substance, not at all attractive. Indeed its touch is dreaded by most people, as it stains the hand and soils the dress. But notwithstanding all its repulsive features, it is one of the most useful substances ever discovered by man. It has done more to spread civilization and to help the progress and advancement of the human race than any other substance existing on the surface of the earth.

Least attractive things in Nature give us most valuable services.

It is rather a queer thing that the least attractive parts of Nature's creation do often render the most valuable service to man. Take for instance the case of the metal iron. It is one of the least attractive of the metals, but it is of the highest importance to mankind. Bright and attractive metals such as gold and silver, are nothing compared to iron as regards its quality of usefulness. Even copper which excels iron in colour and appearance is inferior

* A lecture delivered at the Calcutta University Institute on 1st October, 1902, with which has been incorporated an article by the author on the *Genesis of Coal* which appeared in the Scottish Churches College Magazine, January, 1920.—*EDITOR.*

to it as a useful metal. We often find that the most beautiful birds do not always possess the sweetest voice; the brightest flowers do not always yield the best aroma, nor does the attractive exterior of a human being guarantee the excellence of head and heart. This is, in the highest degree, true in the case of coal. A glance at the samples arranged on the table will give you some idea of the number of substances obtained from coal, but only a few have been collected by me and a many more are not represented here. They are all extremely useful to us in some way or other. It is impossible to give even a short description of these various substances in the course of a single lecture. I, therefore, propose to briefly touch upon subjects relating to the geological origin and industrial value of coal and to confine myself chiefly to a consideration of the general chemistry of coal.

II. What is Coal? Its Chemical Nature.

First of all, the question may naturally be asked, what is coal and how is it produced?

Coal is a form of carbon.—Three forms of carbon.—Properties of diamond.

Well, coal is a form of carbon which you know to be one of the elementary substances. Carbon exists in three distinct forms. The first is represented by the brightest and the most precious of gems known as diamond—bright,

transparent, crystalline and extremely hard, often colourless but sometimes coloured; the most brilliant and costly of ornaments but the least useful of all the three varieties of carbon. Its chief industrial use is for cutting glass.

Diamond and coal are different forms of one and the same substance.

It is impossible to believe that diamond and coal are the different forms of one and the same substance, but nevertheless it is so. Diamond when subjected to the intense heat of a voltaic arc swells up into a black coke-like mass which burns in air and producess carbon dioxide gas, much as a piece of coal does under similar conditions, proving that this most precious gem is nothing chemically but a different form of charcoal or coal.

Recently, very minute pieces of diamond have been artificially prepared, but they are not comparable to the natural variety.

Graphite, its properties.

The second variety of carbon is known as graphite; it is also called plumbago or black lead. It is either amorphous or crystalline like diamond but dark grey, shining and soft.

You see on the table specimens of graphite combustion tubes, graphite crucibles and gun-powder coated with graphite.

It is more useful than diamond and is found in large quantities in Ceylon and in certain localities in Southern India.

The Ceylon variety is much superior to that obtained from the Southern Presidency.

Uses of graphite :—Industry of pencil-making.

Graphite leaves a dark stain when drawn on paper ; the wooden pencil which we use is made from graphite. In making pencils, graphite is mixed with pure clay and consolidated by hydraulic pressure. Graphite is obtainable in such large quantities in India and Ceylon and the art of pencil-making is so simple, that the starting of this industry in India ought to engage the serious attention of the enterprising section of the Indian people.

Graphite is used for protecting surfaces of iron from rusting, for lubricating parts of machinery to minimise friction, and in certain electrical operations, such as electro-typing, it being a good conductor of electricity. Crucibles for melting metals are made of a mixture of graphite and fire-clay ; these withstand very high temperatures.

Sources of lampblack—its uses.

The third variety of carbon is non-crystalline and is represented by lampblack, charcoal and coal. Lampblack is the purest form of non-crystalline carbon. It is obtained by the imperfect combustion of oils, of resinous and tarry matters and of coal. It is largely used as an ingredient of printing ink and of blacking for shoes.

Charcoal—wood and animal ; how obtained.

The next variety of non-crystalline carbon is charcoal which is of two kinds ; one, known as wood-charcoal, is obtained by burning wood without access of air ; and the other, known as bone-black or animal charcoal, is obtained by heating bone and other animal tissues under similar conditions. If wood is burnt with free access of air, it is entirely consumed and becomes changed into certain invisible gases to which I shall have occasion to refer later on, leaving a small quantity of a white residue known as ash, consisting of mineral substances contained in the wood.

It may not be out of place here to describe briefly some of the important properties of charcoal.

Properties of charcoal :—(1). Destroyer of bad smell.

One of the important properties of charcoal is that it destroys bad smell and consequently purifies the air ; it is, therefore, largely used in hospitals, dissecting rooms and in other places where the air is being constantly contaminated by obnoxious effluvia. The pores of charcoal have the property of absorbing foul gases to a considerable degree, and these, being acted upon by the oxygen of the air contained in the pores, are converted into odourless and harmless substances. Charcoal absorbs *ammonia* gas, which, as you know, is one of the ordinary products of putrefaction of organic substances containing nitrogen.

Owing to this property, charcoal is also used to sweeten fish and other subtances which have undergone incipient decomposition. Dead and putrid animals, such as rats and cats, found near dwelling houses, will cease to emit offensive odour when covered with a thick layer of charcoal till they are disposed of.

(2). Destroys organic matter:—used for filtering water.

Charcoal also destroys organic matter and is, therefore, largely used for filtering drinking water. When it is used for this purpose, it should be frequently cleansed; otherwise the constant filtering will cause an accumulation of organic impurities in its pores which will make it not only an useless, but often, a dangerous filtering medium.

(3) Absorbs vegetable colouring matter: used in refining sugar.

Charcoal also possesses the property of absorbing vegetable colours; it is, therefore, largely employed for decolourising juices of sugar-cane and beet root made into syrup in the manufacture of sugar. Bone charcoal possesses this property in a much superior degree to wood charcoal. The syrup becomes quite colourless when passed through a thick layer of animal charcoal and when concentrated by heat, beautiful colourless crystals of sugar separate out.

Coal, the cheapest source of artificial heat, light and of mechanical energy.

Coal is the last and the most impure form of non-crystalline carbon; for besides carbon, even the best variety of coal contains a number of other elementary substances, though

in small proportions only, such as *oxygen*, *hydrogen*, *nitrogen*, *sulphur &c*, and some *mineral substances* which constitute the *ash* of the coal. Coal is the cheapest but at the same time the most valuable source of artificial heat and light and of mechanical power. Railways, steamships and mills which have done so much to raise the social and political life of the civillized countries, all depend upon the regular and abundant supply of coal for their successful working and it is hard to imagine what the state of the civilized world would be if there were a sudden stoppage of the supply of coal.

Means likely to replace coal—Electricity.

We have fortunately no such contingency to apprehend in the near future; but taking into consideration the enormous annual expenditure of coal all over the world and the fact that the coal-producing function of the earth has practically ceased, no doubt can be entertained about the exhaustion of its supply some day or other, and the prospect, therefore, though distant it be, is not at all assuring. But happily recent events have shown that there is not much cause for anxiety in this respect. *Electricity* has already been slowly but surely encroaching upon the legitimate functions of coal, and both as an illuminating agent and as a source of mechanical energy, it has already become its formidable rival and there is little doubt that before long, coal will be a thing of the past, interesting

to the geologist only, and will adorn the shelves of the Museum in preference to the coal-bunkers of steamships and the "tenders" of engines. Twenty years ago (1882), a scientist discussed the question of the exhaustion of coal-supply and he ventured to hope "that science would come to our aid by lightening our streets, our factories and our houses by electricity instead of with coal-gas; by propelling our railway trains and ships by means of electric currents instead of steam, and by carrying our many large and important industries with the aid of the same invisible but most potent agent instead of coal." Need I tell you, gentlemen, that his anticipations have been largely realised within the brief space of twenty years only.

Industrial importance.

The importance of coal in the development of industries cannot be over-estimated. England owes her present industrial and commercial supremacy to coal. Lord Inchape, speaking recently on the question of nationalisation of coal, observed that it was no exaggeration to say that coal had been the maker of modern Britain and that those who discovered and developed the methods of working it had done more to determine the bent of the British activities and the form of British society than all Parliaments of the past 120 years.

III. The Genesis of Coal.

Coal is a form of carbon manufactured in the store-house of Nature. Its origin is as interesting and wonderful as its chemistry. In this paper, we shall briefly deal with the origin of coal.

In order to study the genesis of coal, we must go back to a far remote age in the history of our globe, long before man made his first appearance on the earth, when the geography of the earth was entirely different from what it is now.

As we divide the life of a man into infancy, childhood, youth, adolescence and old age according to his development, so geologists have divided the life of our earth into several periods, based on the stages of development and growth of her solid body. For the solid part of the earth is not one layer of uniform composition but consists of innumerable strata of different thickness and varying composition, formed during different periods of her life, each period sometimes extending to millions of years. We must not, however, suppose that our earth was solid at all periods of her existence. According to some, there was a time, far beyond the limits of our calculation, when our earth was not solid at all but consisted of a mass of luminous vapour forming part of the body of a *nebula* which was the progenitor of the present solar system. The solar system

which now consists of a galaxy of brilliant planets with the Sun in the centre and with satellites revolving round some of them, at one time existed in a nebulous condition i.e., as a cloudlike mass of thin luminous vapour extending over a limitless space. In course of time, this nebulous mass began to cool down at the surface and condense and contract. During its revolution at tremendous velocity, fragments separated from the general body in the form of rings. Some of these rings still form the satellites of some of the planets, such as the Saturn ; other rings ultimately broke up during their revolution, coalesced, became more and more cooled and condensed and finally solidified and became separate units of the present solar system of which our earth is one. The beautiful Moon at one time formed part of the body of our earth but it separated from her in course of time and became her satellite. The Sun is the remaining intensely hot nucleus of the original nebulous solar system.

The matter of which the earth was composed began to cool at the surface. Water was first formed by condensation and it enveloped the mass of the molten earth all round forming a vast ocean, the water of which was in a boiling condition. The other matter composing the body of the earth gradually became liquid and plastic. Her shape as a globe with flatness at the poles

and bulging at the equator is a proof of her being in a plastic condition at some period of her existence, the flattening at the ends and the bulging in the centre having been caused by her rapid revolution while she was in a plastic condition.

The cooling and contraction proceeded until the mineral matter on the surface became hard and it formed the primitive solid part of the body of the earth. No trace, Prof. Geike observes, has yet been found of the first crust that was formed upon the surface of the earth. This must have been broken up into fragments and sunk into the molten mass beneath. And perhaps many such formations and breakages took place until finally a permanent solid crust was formed which could remain solid, although still red-hot. During this process of cooling and contraction, violent contortions, crumplings and fractures of the surface of the earth took place, resulting in tremendous upheavals and sinkings of the surface, attended with volcanic eruptions and frequent earthquakes of unprecedented violence. During the upheavals of the earth, portions of solid matter were pushed up in the form of high mountains which thus formed the first outlines of land. Other portions sank down and formed the beds of deep seas. By the disintegrating action of water, the high mountainous lands became slowly worn out and the debris carried down and deposited on the low lands and in the

beds of deep seas. This deposit of sand, mud and silt gradually raised the beds of seas, layer by layer, supplemented by beds of varying thickness, sometimes many thousands of feet deep, composed of vegetable matter and shells of dead marine animals such as the foraminifera and others, the composition of each bed varying with the materials available during that particular period in the life of the earth. These beds of buried vegetation have been subsequently transformed into beds of coal. All these beds are geologically known as *rocks*.

"Blown sand, peat, coal, sandstone, limestone, lava, granite, though so unlike each other, are all included under the general term of "rocks." Those rocks that were gradually formed by the deposit of some kind of sediment usually in some basin full of water, are called the *sedimentary rocks*. The sedimentary rocks do not carry us back to the beginning of things; they are, therefore, derivative and presuppose the existence of some older rock from which they could be derived."

The rock which first formed the nucleus of the solid crust of the earth is called the *primitive rock*; this was produced by the cooling, consolidation and solidification of the mineral body of the earth. Many of the primitive rocks are foliated in structure and others have been metamorphosed by pressure. Then there is the third class of rocks called the *eruptive*

rocks which have been erupted from underneath into the crust or on the surface of the earth. They are all of volcanic origin. Lava is a common example of an eruptive rock. The primitive rock would naturally form the lowest layer of the crust of the earth, and there would have been no possibility of our reaching and examining it (as it lies too deep and is too hot), had it not been for the countless cataclysms from which our globe suffered at that remote age and which were responsible for the many upward and downward movements of its surface. In consequence of the violent up and down movements, the deepest layers of the primitive rocks in some places were pushed up and they now form part of the surface of the earth. The deepest layers of the crust of the earth have thus been brought within the scope of our observation and examination along with the more superficial layers which were formed at comparatively recent dates.

Our globe at present consists roughly of three layers. The outermost layer forms a gaseous envelope which is the atmospheric air which surrounds the globe and extends to about 50 miles or more above the surface of the earth. The middle layer is the mass of water which cover nearly two-thirds of the surface of the globe in the form of lakes, rivers, seas and oceans. The innermost layer is solid, made up of strata of rocks of variable composition which we call the crust of the earth and which at

places are above the surface of the water, constituting the land on which we live.

The surface of the earth is quite cold now, but there is abundant evidence to show that the interior of the earth is still intensely hot. The occasional manifestation of volcanic erptions and the existence of hot springs point to intense pent-up heat within the womb of the earth. At a depth of about 45 miles, the heat is so intense that rocks and other mineral matters existing there are in a red-hot state of fusion. The core of the earth was at one time believed to be in a fluid state on account of this intense heat but scientists now believe that the central part of the earth, though intensely hot, is solid and compact owing to the enormous pressure thrown upon it by the solid crust of the earth, and all the heavy metals, such as iron etc., are there owing to their high specific gravity. Some think that the interior of the earth is gaseous, but owing to the high pressure to which it is subjected, it behaves like a solid. It appears, however, from seismological considerations, that the central core of the earth consists of a heavy metallic material.

"The main divisions of the geological record and, we may say also, of the geological times, are five :—

(1) *Archaean*, embracing the periods of the earliest rocks wherein no traces of organic life occur. (2) *Palæozoic* (Ancient life) or *Primary*, including the long succession of ages

during which the earliest types of life existed. (3) *Mesozoic* (Middle life) or *Secondary*, comprising a series of periods when more advanced types of life flourished. (4) *Cainozoic* (Recent life) or *Tertiary*, embracing the ages when the existing types of life appeared, but excluding man. (5) *Quaternary* or *Post-tertiary* and *Recent*, including the time since man appeared on the earth."—*Geike.*

All the above ages were not of the same duration. The *Archaean* age was probably vastly more prolonged than any of the others, while the last age comprises a much briefer period of time than the rest.

Each of the main divisions is further subdivided into systems or periods. For example, the *Palæozoic age* is subdivided into such periods as the Cambrian, the Ordo-vician, the Silurian, the Devonian, the Carboniferous and the Permian; the *Mesozoic* into the Triassic, the Jurassic, the Creataceous &c. These periods are named either after the places where they most abundantly occur or from the nature of the rocks themselves.

I have already stated that owing to the disturbances which the crust of the earth has undergone, there have been pushed up to the surface, from underneath the oldest fossiliferous strata, certain very ancient crystalline rocks which formed what is termed the Archaean system. These rocks have by some geologists been supposed to be a part of the primeval crust

of the planet which solidified from fusion. By others, they are believed to have been formed in the boiling ocean which first condensed upon the still hot surface of the globe. These rocks present a foliated and crystalline structure. They are often intensely crumpled and puckered, having evidently undergone enormous crushing through terrestrial disturbances. They are, therefore, called *schists* and some of them have undergone such changes from their original condition that they are also called *metamorphosed rocks*. Very scanty traces of organic life have been detected among the archaean rocks.

" The archaean rocks cover a large area of Europe. Both in the old and new world, the Archaean rocks are chiefly exposed in the northern tracts of the continents. The areas which they there overspread were probably land at an early geological period, and it was the waste of this land that mainly supplied the original materials out of which the enormous masses of stratified rocks were formed. The whole of the central part of Europe once formed the bed of a deep sea which was subsequently raised up by the formation of sedimentary rocks, "

We thus see that the formation of the *rocks* constituting the crust of the earth took place at different periods of her life. The earliest rocks fall under the Archaean section ; these rocks have been called the primitive rocks. There was very little vegetable or animal

life on the surface of the earth during that time, the conditions then not being very favourable for the existence of life. It is for this reason that we do not practically find any fossil remains of plants and animals embedded in such *rocks*, as you find in all other *rocks* of later origin. During the later ages, the surface of the earth, sufficiently cooled down, gradually became fit for supporting plant and animal life. In the earliest periods, only the lowest forms of plant and animal life were to be found in our globe, out of which the higher plants and animals gradually became evolved, until at a later period of the Quaternary age, man first made his appearance on the earth.

The epoch in the life-history of the earth with which we are chiefly concerned in this paper is the Carboniferous period which formed part of Palæozoic or Primary Age. It is so named because the most conspicuous character of this period is the formation of a very large number of beds of coal. The formation of coal-seams is, however, not entirely confined to this period, as small beds of coal could be traced in *rocks* formed in some of the other geological epochs. But a great part of the world's coal had its origin in the Carboniferous period.

Coal has been rightly described as "*compressed and mineralised vegetation*". It is the fossil remains of trees and plants that

once flourished upon the surface of the earth and which, subsequently covered by dense layers of earth and thus protected from the decaying influence of the atmospheric air, had undergone, under the influence of pressure and heat, a kind of change, like dry distillation, by which the other elements composing the wood made their escape as volatile products, leaving carbon in an elementary form associated with small proportions of a few other elements, such as nitrogen, sulphur, hydrogen &c.

Some have ascribed a marine origin to coal, it having been formed by the carbonisation of sea-weeds. But the proofs advanced in support of this theory are not unassailable.

The vegetable origin of coal has been established beyond all reasonable doubts. Watt says that "we often find lumps of coal bearing distinct impressions of leaves, fronds and other parts of plants, and sometimes layers may be peeled off which appear to consist of superimposed layers of carbonised leaves". And in support of this, we quote the following passages from Geikie :—"In Britain, each layer of coal is usually underlain by a bed of fireclay or at least of shale, through which roots and rootlets, descending from the under-surface of the coal-seams, branch freely. There can be no doubt that each bed of fireclay is an old soil, while the coal lying upon it represents the matted growth of vegetation which that soil

supported. Hence the association of a fireclay and a coal-seam furnishes distinct evidence of a terrestrial surface".

"If each of these seams marks a former surface of terrestrial vegetation, how is this succession of buried land-surfaces to be accounted for? There is obviously but one solution of the problem. The area over which the coal-seams extend, must have been slowly sinking. During this subsidence, sand, mud and silt were transferred from the neighbouring land and in such quantity as to fill up the shallow water. On the muddy flat thus formed, the vegetation of the flat marshy swamps spread seaward. There may not improbably have been pauses in the downward movement, during which, the maritime jungles and forests continued to flourish and to form a thick matted mass of vegetable matter. When the subsidence recommenced, this mass of living and dead vegetation was carried down beneath water and buried under fresh deposits of sand and mud. As the weight of the sediment increased, the vegetable matter would be gradually compressed and would slowly pass into coal. Again, the marsh-loving plants from the neighbouring swampy shores would creep outward and cover the tract with a new mantle of vegetation which, on the renewal of the downward movement, would be submerged and buried."

Geikie.

During the period of rest in the subsidence of land, the vegetation grew very abundant and thick, and this accounts for the existence of some coal-seams of great depth.

The flora of the carboniferous period were not the highly developed type of plants that flourish at the present time. They were flowerless plants, consisting chiefly of ferns, equisetales, lycopods, etc. Some of these simple plants, unlike their modern representatives, used to grow some 50 or 60 feet high, and formed very dense forests which subsequently turned into extensive deposits of coal of great thickness.

Lignite, bituminous coal and anthracite.

An examination of the structure and composition of the three principal kinds of coal also support the theory of its vegetable origin. For instance, in many specimens of the variety of coal known as *lignite* which is the lowest stage of coal-formation, we still find the remains of wood with its fibres and cells in the midst of a large mass of carbon. It contains only 66 per cent of carbon and a much larger proportion of oxygen aud hydrogen than the other two varieties of coal, and in this respect it approaches more closely the composition of wood. Here I hold in my hand a piece of *lignite* in which you see the entire structure of wood remains almost unchanged; this shows remarkably well the transitional stages of the formation of coal from woody fibres. In the *bituminous* variety of coal, the carbonisation is much more advanced, the precentage of carbon being 78; but even here you will sometimes find clear remains of vegetable structures. The most perfect variety of coal is known as the *anthracite*. It is most compact and heavy and contains 90 per cent of carbon and the least proportions of hydrogen and oxygen. It represents the most advanced stage of the formation of coal and you will seldom find remains of vegetable structures in this variety.

Mode of burning different in the three varities of coal.

The difference in the composition of the several varieties of coal gives rise to a difference in the mode of their burning. *Anthracite* contains very little hydrogen and oxygen, and is, therefore, much less easily combustible than either lignite or bituminous coal; it yields little or no gas and, therefore, it burns with little smoke or flame; but it gives more heat than the other two varieties. The *lignite* yields the largest quantity of gas and, therefore, burns with a large flame. The *bituminous* variety occupies the middle position and is largely used for the manufacture of the coal gas.

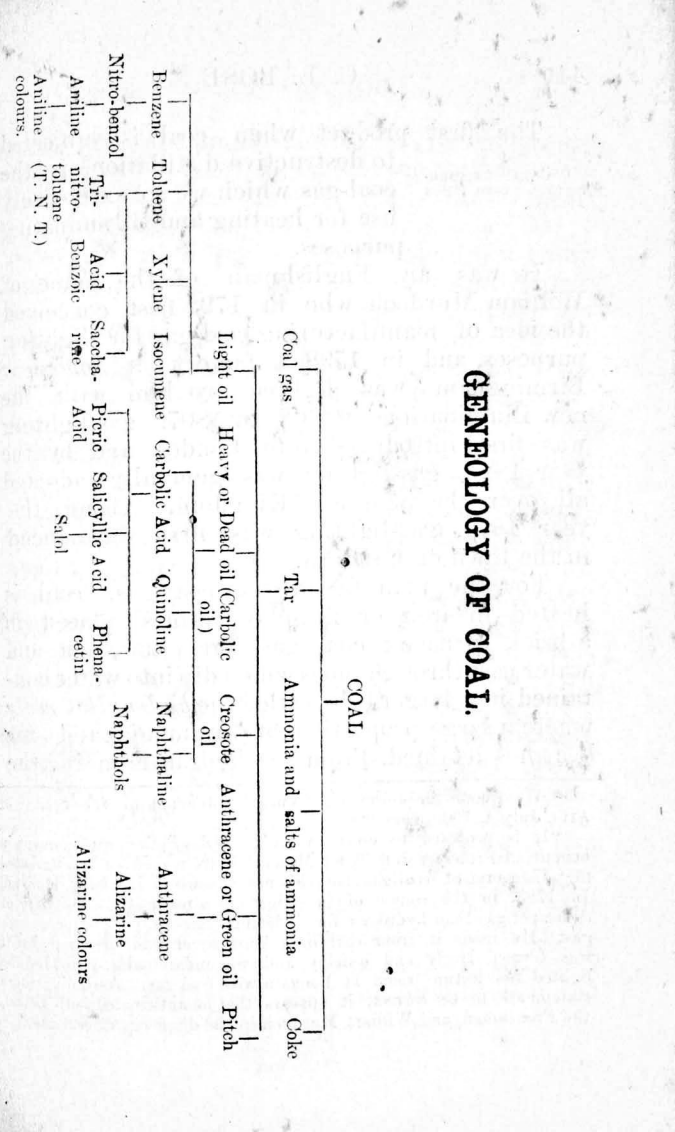
IV. the Chemistry of Coal.

Main products of the dry distillation of coal.

When coal is subjected to destructive or day distillation, i. e., subjected to the influence of heat without access of air, the principal products are–(1) *coal gas*, (2) *tar*, (3) *ammonia* and (4) *coke*

which is the residue left in the vessel in which coal is heated. From *tar*, a large number of by-products are formed which are alike useful and interesting, some of which are solid, others liquid and the rest gaseous. Who among us should have ever thought that this black, hard, unsightly mass of coal could contain colours which will stand favourable comparison with the best produced by Nature's own hand, I mean the *aniline* colours which stand on the table before you and which are represented in the beautiful ribbons hanging on the board there; —that it could contain a substance whiter and softer than the best wax manufactured in Nature's stores, I mean *paraffin*, of which this candle is made;—that it could contain a liquid thinner and lighter than water and extremely diffusible, I mean *benzene*, which you see in this bottle;—that it could contain a gas most penetrating in odour, lighter than air and extremely soluble in water, I mean *ammonia*,—or that it could contain a substance sweeter than the sweetest sugar manufactured in Nature's stores,—I mean *saccharine*. But nevertheless it is a fact that all the substances arranged on this table and many more are derived from coal: I have drawn up on this paper a geneology of coal up to the seventh generation only,—several more generations are in actual existence but I have no space to show them here.

GENEOLOGY OF COAL.



Coal gas—its manufacture, composition and use.

The first product when coal is subjected to destructive distillation, is the coal-gas which we so extensively use for heating and illuminating purposes.

It was an Englishman of the name of William Murdoch who in 1792 first conceived the idea of manufacturing coal-gas for lighting purposes, and in 1798, a factory at *Soho* near Birmingham was lighted by him with the new illuminating agent.* In 1807, gas-lighting was first introduced into London and by the year 1822, gas-lighting was generally adopted all over the United Kingdom. About the year 1870, gas-lighting was first introduced in the town of Calcutta.

For the manufacture of coal-gas, coal is heated in iron or fire-clay retorts placed in a brick furnace ; coal gas, tar, ammonia and water pass through pipes which dip into water contained in a larger tube called the *hydraulic main* where a large proportion of ammonia and tar becomes detained. From the hydraulic main, the

* We quote the following from the Journal of the Society of Arts, July 4, 1902, page 690 :—

"It is proposed to erect by public subscription, a monument in honour of Professor Jan Pieter Minckelers (to whom is now attributed the discovery of coal-gas) in his native town of Limburg, Holland. In 1783, in the course of investigations aiming at the discovery of a cheaper gas than hydrogen for inflating baloons, he produced coal-gas. He made it from coal in a gun-barrel and observed that it was formed freely and quickly and was inflammable. In 1785, he lighted his lecture room at Louvain with coal gas. Assuming these statements to be correct, it appears that he anticipated both Lebon, the Frenchman, and William Murdoch in the discovery of coal-gas."

excess of tar and ammonia with the coal-gas passes into a vessel which is called the *tar-pit*, and from the *tar-pit*, the gas passes into a series of bent tubes known as condensing tubes which are cooled either by exposure to air or being kept under cold water. In these tubes, the remaining portions of the tar and ammonia collect, which are made to flow back into the tar-pit. From the condensing tubes, the coal-gas next passes through an apparatus known as *lime-purifier* which consists of an iron box containing shelves in which is kept slaked lime which deprives the coal-gas of its impurities, such as carbonic acid gas, sulphuretted hydrogen gas and bisulphide of carbon, and next over hydrated iron oxide mixed with sawdust to thoroughly remove sulphuretted hydrogen. The gas is next allowed to pass through another apparatus, called the *scrubber*, consisting of wrought iron pipes filled with coke kept moistened with water trickling over the coke from a cistern placed immediately above the pipes. By this means, the gas is deprived of the last traces of ammonia. The coal-gas thus purified next passes into the gas-holder from which it goes into pipes laid in the thoroughfares for lighting streets and houses. The supply from the gas-holder is kept under control by a stop-cock. The uniform distribution of the gas is maintained by a series of weights attached by iron chains and pullies to the gas-holder.

Composition of coal-gas.

Coal-gas is not a simple substance. It consists of a large number of combustible gases of which marsh-gas, olefiant gas, carbon monoxide and hydrogen are the most important. Neither marsh gas nor hydrogen gives a bright flame; the luminosity of the gas flame is mainly due to the presence in it of olefiant gas and of traces of acetylene and benzene.

Properties of marsh gas; Davy's lamp.

Marsh gas is colourless and odourless, burning in air with a feebly luminous flame.

Marsh gas forms an explosive compound when mixed with atmospheric air. Such a mixture often collects in coal-mines and when a light is brought into it, it takes fire. It has thus caused many a fatal accident in mines. Since the invention of the celebrated lamp by Sir Humphrey Davy, such accidents have become rare.

Olefiant gas.

Olefiant gas is the chief illuminating constituent of the coal-gas. It burns with a bright luminous, smokeless flame. It is a colourless gas having a faint ethereal odour.

Dangers from a leaky coal-gas pipe.

Coal-gas is a poisonous gas, so that when it is used for lighting purposes, leakage of gas from pipes specially in a room should be prevented. There is another danger from leaky pipes. It is this. The escaping coal-gas forms an explosive mixture with the air in the room, and if a light is taken into the room, the mixture explodes and the whole room instantly is in a state of conflagration. Many fatal accidents have thus occurred; very recently in Calcutta, such an accident occured, resulting in death by burn of a poor bearer who unsuspectingly took a light into his master's room in which gas was leaking from a pipe.

Coal-tar: its composition and secondary products.

The next product of the dry distillation of the coal is the coal-tar. It is a useful substance not only by itself, but it yields a large number of by-products which are extensively used in the arts, medicine and sanitary science.

Tar is a complex mixture of a large number of liquid and solid hydro-carbons which separate out when it is subjected to fractional distillation in an iron vessel. Each hydro-carbon contained in the tar has a definite and separate temperature at which it begins to boil and assumes the state of vapour. Thus by regulating the temperature in the process of distillation, we are able to separate the various hydro-carbons one by one.

When tar is first heated, ammonium salts and water pass out and then a *brownish oily liquid* which, under 140°C, collects upon the surface of the water. This oily substance is known as the *light oil* and consists of four hybrocarbons which are lighter than water and which may be separated from one another by

a further fractional distillation of the light oil. These are benzene, toluene, xylene and isocumene, of which benzene is the most important compound.

Benzene.

Benzene is an exceedingly inflammable liquid. It is much lighter than water with which it is not miscible. It has a strong coal-tar smell. It is used for dissolving fats and India-rubber. One of its chief uses is for the manufacture of *aniline* which yields a large number of the beautiful colours known as *aniline dyes.*

Nitro-benzene

when benzene is treated with a mixture of strong sulphuric acid and strong nitric acid, a heavy oily substance is produced known as nitro-benzene which possesses a powerful odour like that of the oil of bitter almonds and is largely used for flavouring confectionery and also in the preparation of perfumeries under the name of *essence of mirbane.* It is a poisonous substance in large doses.

Aniline : aniline dyes.

When nitro-benzene is heated in a retort with glacial acetic acid and iron filings, a colourless oily liquid distills over, which is known as *aniline.* This is the substance from which a large number of very brilliant dyes are obtained; these colours are classified under different groups, such as *aniline red, aniline yellow, aniline blue, aniline green, aniline brown, aniline black* &c., each group containing various shades of the

same colour. Aniline red is commonly known as *magenta* and is prepared by the action of some metallic salts on aniline oil. For instance, when aniline is heated with crystals of perchloride of mercury, a red dye known as aniline red is formed. This dissolves in hot alcohol and when a skein of silk is immersed in this solution, it takes a beautiful red color which is not destroyed by washing.

Salts of copper, iron, tin and arsenic are also used in the same way to produce the different kinds of aniline red.

You see on the table here a few of the aniline colours of different groups collected by me ; you will notice that each group contains a large variety of the same colour differing from one another by depths of shade. The ribbons hung on the board there also give you an idea of varieties of aniline colours.

Saccharine.

From toluene, among other substances, the one known as *saccharine* is obtained. It is white, crystalline, much sweeter than sugar and takes the place of sugar in the food of diabetic patients.

Heavy or Dead Oil.

When no more light oil comes out, the temperature is raised and another oil of a yellow-colour, heavier than water, begins to distil. It is obtained in much larger quantity than the light oil and is known as the *heavy* or *dead oil.* It consists of several liquid and solid hydro-

carbons which separate out at different temperatures.

Carbolic acid.

The first substance obtained from the dead oil is *carbolic acid* which is so largely used in medicine and in sanitary science. It is obtained by treating the *heavy oil* with caustic soda and decomposing the *carbolate of soda* thus formed by strong hydrochloric acid. It is a colourless, crystalline substance, having a strong smell of coal-tar, not much soluble in cold water but more so in boiling water, and readily soluble in alcohol, ether and benzene. It is antiseptic and disinfectant. From carbolic acid are made carbolic powders and various disinfecting liquid substances. The ordinary disinfectants such as phenolyne, phenyle &c., contain very little carbolic acid but consist of a large amount of other coal-tar acids which are inferior to carbolic acid in disinfecting properties, but they destroy bad odour, Other disinfectants such as lysol and izal are also obtained from coal-tar.

Carbolic Acid and its preparations act as strong poisons. The strong acid produces blisters and should, therefore, be carefully handled. It is sometimes used as a poison to commit suicide.

Picric Acid.

When carbolic acid is treated with strong sulphuric and nitric acids, a yellow crystalline substance is obtained which is *picric acid.* It is used as

a pigment and also as a reagent in the laboratory. The acid and many of its compounds are explosive.

Salicylic acid and salicylates.

Salicylic acid was formerly obtained from the oil of certain plants but now it is extensively prepared from carbolic acid. Its salts are called *salicylates* and are much used in medicine. Salicyllic acid is a powerful antiseptic and is added to lime-juice and other food and medicinal preparations to prevent decomposition and fermentation.

Phenacetin, *salol* and various other useful medicines are also obtained from carbolic acid.

Naphthaline.

As the temperature in the process of distillation of coal-tar is further raised, a substance which solidifies on cooling is obtained. This is known as *napthaline* which is white and crystalline, having a strong smell of coal-tar. It yields products called *napthols* which are used in medicine. Napthaline is largely used as an insectiside, placed with books and clothes to protect them from ravages of insects.

Anthracene and alizarine colours.

The last product of the distillation of coal-tar is *anthracene*, a white crystalline substance, having a strong smell of coal-tar. This yields the important product called *alizarine* from which a large number of another class of beautiful dyes called *alizarine dyes* are obtained.

Pitch.

The black viscous substance left in the retort after the distillation of coal-tar is completed, is called *pitch*. It solidifies on cooling and is used for various purposes in the arts; asphalt, which is used for flooring, is made from pitch.

Ammonia and its salts.

Another important product of the dry distillation of coal is *ammonia* from which a large number of salts known as ammonium salts are prepared. They are extensively used in medicine and in the arts.

The ammoniacal liquor of the gas-works is neutralized with hydrochloric acid and evaporated to dryness, when the salt known as chloride of ammonium (*Nishadal*) is obtained. This when heated with slaked lime gives off ammonia gas which may be passed into water in which the gas is extremely soluble. This watery solution is known as solution of ammonia and by neutralising it with different acids, the various salts of ammonium that you see arranged on the table are obtained.

You are well familiar with the pungent smell of ammonia gas. The smelling salt that you use for the relief of headache is a salt of ammonium, known as carbonate of ammonium, which smells strongly of ammonia gas.

Coke, its manufacture and uses.

Coke is the residue of coal left in the retort after all the volatile products mentioned before have been driven off in the process of destructive distillation of coal. It consists mainly of carbon with

a quantity of mineral matter or *ash* contained in the coal. It is extensively used as a fuel for domestic and other purposes, as it gives a smokeless fire. Besides being obtained as a by-product of coal-gas manufacture, it is also prepared on a large scale by burning coal without access of air. It is much used in metallurgical operations.

Paraffin, hard and soft.

The useful substances known as paraffin and paraffin oil are obtained from a certain kind of coal known as *shale* by subjecting it to distillation at low temperatures. Paraffin is a white, soft, wax-like body, largely used now for the manufacture of candles known as paraffin candles.

Both hard and soft paraffin are used as bases for ointments, the softer variety being also used for lubricating purposes.

Gas-carbon.

By the decomposition in the retort of some of the constituents of coal gas, a thick and compact deposit of carbon takes place inside the retorts. This deposit forms the gas-carbon which is a good conductor of electricity and is, therefore, much used in the construction of certain kinds of battery.

V. History and Development of the Coal-industry in India.

Although India is now one of the most important coal-producing countries in the world, nobody seems to have known any thing about the

hidden treasure until some time after the advent of the British in Bengal. During the Mahommedan rule extending over six centuries, no attempt appears to have been made by the ruling race or by the people to discover the presence of coal, and wood and charcoal were used as fuel for all kinds of local industries as well as for domestic purposes. It was in the time of Warren Hastings (1774) that permission was first accorded to two Englishmen (Messrs. Heatly and Summers, servants of the East India Company) to do coal-mining work in the district of Birbhoom. One of them discovered coal in that district, but the coal thus worked was reported to be of bad quality and much inferior to that imported from England. All coal used to be imported from England at that time for the work of the East India Company, and the Directors were anxious to obtain a local supply of coal, if possible, as the transport charges were very heavy. A Mr. Farquhar applied for permission to bore the coal-mines of Jheriah, but the result of his application is not known. The English report on the Indian coal was always unfavourable, and the industry was not developed on this account. To the enlightened action of the Earl of Minto may be attributed the birth of the present prosperous trade in coal. Lord Minto did much to bring the matter to the notice of the Directors of the East India Company. During the Governor-Generalship of the

Marquis of Hastings, Mr. Jones, an expert, was sent from England to examine the Bengal coal-fields in 1815, and he got an advance from the Government of £4000 to enable him to work the mines. He began the work, reported favourably on the quality of the coal, but failed to carry out the work successfully. In 1820, however, some of the Calcutta firms undertook the work. The first coal-mine in Bengal under European capital and European management was opened in 1820 and was called the Ranigunge Mine. The work went on slowly until in 1839, the output of this mine was 36,000 tons. The industry got very great impetus with the opening of the East Indian Railway in 1854. But even then, the progress was very slow until the jute mills of Calcutta and other railways had been started.

Ranigunge, Jheria and Giridih are the most important and the most extensive coal-bearing sites in India. Of all coal obtainable in India, about 90 per cent belongs to the Bengal mines. Output of Indian coal has risen from 36000 tons in 1839 to 20,721,543 tons in 1918, the total value of which is £6,017,089. India is now not only able to supply all her own demand but is exporting coal to other neighbouring countries. The total export of Indian coal in 1918 was 74,466 tons of the value of £52,344. The quantity of coal imported into India in 1917 was 46,455 tons, and 67,441 tons in 1918. Indian coal is now found to be the cheapest of all coals in

the world. There are coal-mines in other parts of India, such as the Central Provinces, Assam, Hyderabad, the Punjab, Sind, Beluchistan, Rajputana and in Burma, but their total yield is only a fraction of what is obtainable from the Bengal mines and their quality also is not so good. There were altogether 307 coal-mines in the whole of India in 1906 of which 274 belonged to Bengal.

The import of foreign coal has been greatly reduced by the increased output of the Indian coal-mines. Bombay being situated at a long distance from the coal-mines, is the consumer of no small quantity of coal imported into India.

The principal difficulty in the way of successful working of a coal-mine lies in the transport of coal from the coal-fields to the consumers. The railway companies cannot always be depended upon to supply the required number of wagons, and this difficulty has considerably increased since the European War broke out in 1914. Hence the price of the commodity rose very high some time ago, but it has come down again.

Bengal is exceptionally fortunate in possessing within her bounds the materials of two industries which she can call her own. They are the coal and the jute. To these two may be added a third, the future of which seems to be very hopeful, I mean the iron industry. Bengal has been found to be rich in iron ores, and her iron fields lie almost contiguous to her coal-mines, which is a most happy conbination from the industrial point of view. Hitherto, these industries had been mainly carried on with European capital and under European management, but with Indian labour only. What is now wanted is that Indian capital should enter the field with Indian brains so as to be able to participate in the great post-war industrial activity of the world. The signs of the time are certainly hopeful, and one may expect to see in near future great development in the coal, jute and iron industries in Bengal with indigenous capital and under indigenous management. Messers. Tata and Co. of Bombay have shown the way. We hope Bengal will follow their lead and succeed in developing her rich mineral and agricultural resources to the greater contentment and prosperity of the land and her people.

Combustion.*

After passing the Matriculation Examination, you will have to commence the study of Science, of which Physics and Chemistry are two very important branches. Last year, I had the privilege of addressing a similar gathering on a similar occasion and chose Electricity as the subject of my lecture. I have thought right to select a chemical subject for the present occasion and in doing so, I tried to fix upon one which would not only be most familiar to you but which could be presented in such a form as to suit the understanding of those who have not yet commenced the study of Science.

Combustion is no doubt a most common-place phenomenon in our domestic life ; for what house is there in which a fire is not lighted or a lamp is not burnt ? But although combustion is such a common-place subject, its study, as you will come to know by and by, played a most important part in the dovelopment of the Science of Chemistry. My own idea is, that the study of Science should begin with an enquiry into the causes of the most

* A lecture delivered at the Calcutta University Institute to mufussil Matriculation candidates on 7th March, 1905, and published in the Calcutta University Magazine, 1905.

common-place phenomena occuring in Nature ; then the student would be expected to take much greater interest in his subject and the facts concerning them could then be more readly understood.

Chemistry has a much wider application in the operations of Nature than any other branch of Science. All processes carried on in Nature's laboratory pertaining to the birth, growth and decay of life, both animal and vegetable, are essentially chemical processes. Chemistry also plays a most important part in the transformation perpetually occuring in the great mineral kingdom of Nature. If my lecture of this day will help to create in you a taste for and an interest in the study of the Science of Chemistry, I shall consider my labours amply recompensed.

Combustion ordinarily means *burning of substances in air*, the act being accompanied by the production of heat and light. When we see a piece of wood or coal burning in a furnace, we say that the substance is undergoing combustion, and we feel the heat and see the light produced by the act.

In the infant days of chemistry, the phenomenon of substances burning in air attracted much attention. The early investigators held that bodies which burnt in the air, such as charcoal, sulphur and phosphorus, contained a substance which they named *phlogiston*, and which, they believed, was

parted with by the combustible body in the act of burning. The more *phlogiston* a body contained, the more actively did it burn in the air. Phosphorus, charcoal, sulphur &c., which readly and briskly burnt in the air, were supposed to contain the largest quantity phlogiston ; and such metals, as zinc, lead and tin, which burnt only when strongly heated, were held to contain the least amount of *phlogiston*. The residue of combustion was called a *calx* ; a *calx* could no longer burn as it contained no more *phlogiston*. A *calx* was indeed believed to be the original substance minus *phlogiston* which had been removed by heat. If, however, by any means, *phlogiston* could be resupplied to it, a *calx* could again be turned into the original substance. For instance, lead, when it was burnt, parted with *phlogiston* and was reduced to a yellowish ash which was the *calx* of lead. When this *calx* was heated again with a substance saturated with *phlogiston*, such as charcoal, it was reconverted into metallic lead.

The existence of substances which do not burn such as stone, sand, chalk &c., was explained by the supposition that at some previous time, the phlogiston contained in them had been dissipated by the action of heat; and as they no longer contained phlogiston, they could not burn.

The *phlogiston* theory of combustion held its sway up to the latter end of the 18th century and had for its advocates such eminent men as Stahl, Cavendish, Black and Boyle to whom the Science of Chemistry owes so much for its present state of evolution. This theory, although an erroneous one, did great service to chemistry in its early days, as with its help, "it was found easy to explain in a simple and intelligent way a mass of facts which had hitherto remained unconnected ; it thus gave a stimulus to fresh enquiry" which led to the discovery of new facts and phenomena which, within a brief space of time, helped to raise chemistry from its early chaotic condition to the dignity of a science.

When the chemical balance came into more general use, people began to doubt the correctness of the phlogiston theory. It was found with the help of the balance that certain metals such as lead and tin, after being burnt in air, gained in weight. According to the phlogiston theory, one would expect to find loss of weight in the burnt substance instead of a gain, the loss being attributed to the escape of phlogiston from the original substance in the act of burning; but a converse result was obtained by actual experiments. In 1772, Rutherford discovered nitrogen in the atmosphere and two years afterwards, Priestly discovered oxygen as the other constituent of the air. It was after the discovery of the constituents of the air that

the phlogiston theory of combustion was seriously questioned and finally abandoned, and a true explanation of the changes by burning was found out. Mayow, however, deserves the credit of having pointed out about a century earlier that combustion consisted in the union of something with the burning body, and that something was one of the constituents of the air. It was he also who first suggested that combustion and respiration were analogous processes. It was left to Lavoisier, however, to prove definitely the inaccuracy of the phlogiston theory. It was he who first demonstrated by well-devised and well-executed experiments that the burning of substances in the air consisted in a chemical union of their constituents with the oxygen of the air and that the energy of such chemical combination was manifested by the evolution of light and heat. He also proved that combution and respiration are identical processes; that in both cases, the union of combustible substances with the oxygen of the air takes place and that in both, the products of combustion are the same.

We now know that for any combustion in the ordinary sense of the term to take place, the presence of air is an absolute necessity, and that combustion is a purely chemical process. Substances cannot burn in the absence of air. If there was no air, we could not light a fire; our food could not be cooked; our homes would be destitute of a comfortable fire-place in the

cold months of the year, and we could not light a lamp to remove the darkness of the night.

As absence of air stops all burning, so the admission of more air to burning substances causes the combustion to proceed more vigorously. We see an every day instance of this in a blacksmith's shop when he blows in air by means of a pair of bellows into the furnace in which charcoal is being burnt. The more vigorously the bellows are worked, the more quickly the fire spreads and glows. When a fire breaks out, one of the greatest obstacles in the way of its being put out is the strong wind that blows into the fire from all directions and fans it, as it were, into an irrepressible flame.

Air has now been proved to be chiefly a mixture of nitrogen and oxygen, and it is the oxygen of the air that supports the combustion of substances. If we remove oxygen from the air, bodies can no longer burn in it. There are certain substances which are capable of removing oxygen from the air when burnt in it; phosphorus is such a substance. If we burn phosphorus in confined air, it takes up all the oxygen contained in that quantity of air, forming a white solid substance which settles down and leaves nitrogen only in the confined space. We may call this nitrogen as *air deprived of oxygen*. Such *air*, however, does not support the combustion of substances as will be seen from the following experiment :—

This glass vessel which we call a bell-jar, contains air. Before burning phosphorus in the bell-jar, let me introduce a lighted taper into it when it will burn as in outside air. I shall now remove the oxygen from the air of the bell-jar by burning some phosphorus in it; you will see that after this operation, the air of the bell-jar will no longer support the combustion of the taper.

Experiment 1.—Burn a piece of phosphorus within a bell-jar provided with a stopper at the top and marked into 6 equal divisions and standing over water in such a way that the lower-most division remains filled with water. Allow the white fumes to subside when water will be found to rise and fill up another division. Now introduce a burning candle into the bell-jar through the top opening. The candle is extinguished

You see, therefore, that it is the oxygen of the air which helps the burning of substances and that nitrogen which is the other constituent of the air is incapable of supporting combustion. This may be shown very effectively by the following experiment:—

Experiment 2.—Take two bell-jars—the one containing nitrogen is placed over the other containing oxygen:—Introduce a lighted taper; it goes out at once in the upper jar containing nitrogen, but when quickly pushed into the lower jar containing oxygen while the wick is still glowing, it will burst into a flame. The operation may be repreated several times.

The first experiment also proves roughly that air contains only about $\frac{1}{5}$ of its volume of oxygen whose place has been taken up by the rising of the water in the bell-jar, the remaining $\frac{4}{5}$ being nitrogen.

Substances like oxygen which help the burning of bodies are called supporters of combustion, while those that actually burn such as charcoal, sulphur, phosphorous, coal, oil, wax, candle and wood, are called combustible or inflammable substances. Hydrogen gas is a highly combustible substance.

We now see that, for combustion to take place, the presence of a combustible substance and a supporter of combustion is necessary. When coal is burnt in a furnace, the carbon of the coal which is a combustible substance unites chemically with the oxygen of the air which is a supporter of combustion, such union being attended with the production of heat and light.

A piece of wood or a wax candle is made of hydrogen, carbon and oxygen; when wood or candle burns, its carbon and hydrogen (both of which are combustible substances) unite with the oxygen of the air which supports their combustion.

We all know how brightly coal, wood, candle or oil burns in air; but I have shown you by the first experiment that air contains only $\frac{1}{5}$ of its volume of oxygen and that the other $\frac{4}{5}$ of the air is nitrogen which does not support combustion. Now, if bodies can burn so brightly in air which contains such a small proportion of oxygen, you will naturally expect that they will burn much more actively, if they are placed in pure oxygen gas and I can show you by some experiments that is really the case, *viz.*, that bodies which burn in air, burn with much

increased brilliancy when placed in pure oxygen gas.

Before, however, we make these experiments, we must obtain some pure oxygen gas It is not easy to get pure oxygen direct from the air; but we can get it readily from certain solid substances in which it exists in combination with certain other elements. The commonest substance from which oxygen can readily be obtained is chlorate of potash; most of you are familiar with this substance as it forms an important ingredient in many fire-work compositions. When you heat chlorate of potassium, it is decomposed into oxygen gas and another solid substance; by a suitable arrangement, the oxygen thus produced may be collected in wide-mouthed glass bottles when it may be submitted to our experiments. We have collected oxygen in these bottles that you see placed on the table here.

Let me show you the production of pure oxygen on a small scale.

Experiment 3.—Place some chlorate of potash in a dry test-tube and heat it in a Bunsen flame; it melts and then begins to boil. Introduce a glowing chip of wood into the test-tube when this substance is boiling; it bursts into a flame.

The best test for oxygen is that when a glowing chip of wood is introduced into the pure gas, it bursts into a flame. It does not behave so in air, because, as I have already told you, there the oxygen remains largely diluted with nitrogen gas.

Let us now see if the combustion of substances is more vigorous in pure oxygen gas than in air. This candle is burning in the air, and you see it is giving a good light; now let us put it into a jar of oxygen gas; see how much more brightly it burns there.

Experiment 4.—Introduce a lighted taper fixed to a bent piece of wire into an oxygen bottle; it emits a bright light.

Charcoal becomes dull-red only when burnt in air; but if a piece of glowing charcoal is introduced into a jar of oxygen gas, the combustion is very active.

Experiment 5.—Introduce a glowing piece of charcoal fixed to a piece of wire into a jar of oxygen gas; it glows intensely and a shower of sparks is given off.

Sulphur, as you know, burns with a pale blue flame in the air which is scarcely visible in broad day-light; but if allowed to burn in oxygen gas, it emits a bright blue light.

Experiment 6.—Introduce burning sulphur in a deflagrating spoon into a jar of oxygen gas; a bright blue light is produced.

Phosphorus ordinarily burns in air with a bright white light; if burning phosphorus is introduced into oxygen gas, it emits a dazzling white light.

Experiment 7.—Introduce burning phosphorus in a deflagrating spoon into a jar of oxygen gas; the light is very brilliant.

You are all familiar with the intense brightness of the light given by the burning of a magnesium wire in air; when the wire is burnt in pure oxygen gas, the light emitted is so intensely bright that we can not look at it without discomfort.

Experiment 8.—Introduce a piece of burning magnesium wire into a jar of oxygen gas; the light emitted is intensely bright.

We have so far seen that substances which burn in air burn with increased brilliancy in oxygen gas. I wish to show you now that certain substances which do not readily burn in air, may be made to burn in pure oxygen gas. Iron is one of these substances. You can heat iron sufficiently strong to make it red-hot or even white-hot, but ordinarily it does not burn like a piece of splinter. It burns beautifully however when put into pure oxygen gas, throwing off a shower of sparks.

Experiment 9.—Introduce oxygen into a bell-jar open at both ends from a gas-holder. Take a straightened-out watch-spring; dip one of its ends into melted sulphur; ignite the sulphur and introduce the burning sulphur-coated end into the bell-jar; the iron wire will burn and give off sparks.

Such union of substances with oxygen is called *oxidation*. In all previous cases, a raising of temperature was necessary to effect oxidation, but oxidation can also take place at the ordinary temperature. Thus the rusting of iron kept in a damp place is an example of oxidation taking place at the ordinary temperature. I can show you by another experiment that phosphorus undergoes oxidation at the ordinary temperature. If fine particles of phosphorus are exposed to air, they slowly combine with oxygen and the heat of the union is sufficient to ignite the phosphorus. I have dissolved some phosphorus in a thin colourless liquid called carbon disulphide which evaporates very

quickly when exposed to air. If some of this liquid which looks like water is sprinkled over a combustible substance such as a piece of paper, the fluid will quickly evaporate and leave phosphorus on the paper in a fine state of division which will unite with oxygen of the air at the ordinary temperature and burn, setting fire to the piece of paper. This liquid substance is known by the name of Greek fire.

Combustion may sometimes be attended with explosion. When a combustible substance is intimately mixed with another substance which is a supporter of combustion and then subjected to the action of high temperature or friction or percussion, union takes place between them in such a violent manner that a loud report, often accompanied by a vivid flash, is the result. So much heat is produced by such sudden and violent chemical union that the resulting products of combustion, which are mostly gaseous, undergo an enormous expansion in volume, and their concussion with the surrounding air produces the loud report. Gun-powder is an explosive substance. It is made of saltpetre which is a supporter of combustion (by virtue of its containing oxygen which is given off when it is strongly heated), and charcoal and sulphur both of which are combustible substances. When you ignite gun-powder, the combustion is sudden and violent attended with a flash.

Experiment 11½.—Burn gun-powder on a plate.

When gun-powder is kept in a closed vessel and then ignited, its explosive power is most manifested, the vessel being shattered to pieces by the force of the explosion. We have examples of this in the explosion of bombs, rockets and other pieces of fire-works and in the expulsion of bullets from guns. Masses of rocks are thus blown off by gun-powder placed in holes bored into them and ignited by means of a fuse or an electric spark. A mixture of this kind when subjected to percussion often explodes with violence. I have already told you that chlorate of potash is a substance which readly parts with its oxygen when heated ; and if it is mixed with a combustible substance such as sulphur and then submitted to percussion, the union between the two takes place with violence attended with a loud report.

Experiment 12.—Place a little sulphur and chlorate of potash in a wedgewood mortar and rub them together with the pestle. A loud crackling noise is produced.

Chlorate of potash and sulphur form ingredients of many fire-work compositions and people through ignorance, in attempting to mix large quantities of these substances together in a mortar, are known to have suffered severely and even fatally from the effects of violent explosion. These substances should never be rubbed together ; each should be

separately powdered and then the two should be gently mixed together with a spatula.

A mixture of antimony sulphide and chlorate of potash also forms an explosive compound ; if a little of this mixture be wrapped up in a piece of paper and then struck with a hammer on an anvil, a loud report is produced.

Experiment 13.—Wrap up some dry mixture of chlorate of potash and antimony sulphide in several folds of paper ; place the packet on an anvil and strike it with a hammer. A loud report will be produced.

I have told you that hydrogen is one of the most combustible substances known. It is an invisible gas which burns with a non-luminous flame when lighted, with the production of water.

Experiment 14.—Burn hydrogen issuing from the generating apparatus and hold a cold glass tumbler over the flame. Droplets of water collect on the inside of the tumbler.

If hydrogen gas is mixed with oxygen in the proportions of two volumes of the former with one volume of the latter, an extremely explosive mixture is fomed which explodes with a loud report when a light is applied to it. In this soda-water bottle, we have taken a mixture of hydrogen and oxygen in the proportions stated above, and if a light is applied to the mouth of the bottle, the gases will unite with a loud report.

Experiment 15.—Fill up a soda-water bottle with two volumes of hydrogen and one volume of oxygen, put in the cork and keep its mouth downwards in a vessel containing water. Take out the bottle, remove the cork and present the mouth to a flame ; a loud report is produced

Ordinary combustion is accompanied with the production of heat and light. In order to produce the light, substances undergoing combustion must first be converted by heat into an inflammable gas which, in the act burning, produces the flame. A substance which cannot be converted into gas does not give a flame. Charcoal is such a substance; it is not converted into gas even at a very high temperature; therefore it glows but does not give a flame. Sulphur on the other hand when heated is converted into gas which burns with a pale blue flame. In the case of coal-gas or oil-gas, no such transformation is necessary, as the combustible substance is already in the gaseous condition. But when a candle burns, the solid wax is first melted by the heated wick and is then converted into certain gases which burn round the wick and give the bright flame.

If you carefully examine the flame of this candle, you will notice that it consists of three concentric zones. There is the dark one in the centre immediately surrounding the wick: it is called the dark central zone. Then immediately outside this zone is the bright part of the flame which is its source of light. This bright zone is called the luminous zone. Outside this, there is a third zone of very narrow width, which is scarcely visible in broad daylight; this is called the outermost or non-luminous zone of the flame.

In the dark central zone of the flame, there is neither light nor heat; the combustible gas in an unburnt condition exists there. We can prove this by a few experiments.

Experiment 16.—Depress a piece of thick card-board on the flame of a candle; a dark ring is imprinted on the paper, the centre of which remains white.

This shows that if there was heat or light in the central part of the flame, the paper there would have been singed.

Experiment 17.—Put a little gun-powder on a cork and place it on a porcelain plate; pour some spirits of wine on the plate taking care that none of it touches the gun-powder. Ignite the spirit which will burn with a large flame all round the inflammable gun-powder without its catching fire. It shows plainly that the central part of this large flame is devoid of heat and light.

Experiment 18.—Introduce quickly a match-head in the dark central zone and take it out almost immediately; it does not catch fire, showing absence of heat and light there.

I have told you that there is only unburnt gas in the central part of the flame. If we can draw away this gas from the central part of the flame and cause it to burn, the proof of my assertion will be complete.

Experiment 19.—Draw out unburnt coal-gas from the central part of a coal-gas flame by means of a syphon arrangement and collect it in a flask; apply a light to the gas as it issues from a jet fitted to the flask; it will burn like ordinary coal-gas.

The bright or luminous zone of the flame contains particles of carbon (separated from the gas during its combustion) raised to a state of incandescence by the heat of the flame. There is not plenty of oxygen in this part of the flame; hence the carbon particles are not completely burnt off. If there were no carbon

particles in this part of the flame, the flame would not give any light. It is the presence of solid particles in a flame raised to white heat that causes its luminosity. The flame of hydrogen is very hot, but as it contains no solid particles, it gives no light; in fact, it is almost invisible in broad daylight.

Experiment 20.—Burn hydrogen issuing from a generating apparatus through a platinum jet; the flame is non-luminous.

We can, however, make it bright by allowing certain solid particles to come into contact with it, when they will be raised to incandescence by the intense heat of the hydrogen flame and the flame will thus be rendered visible.

Experiment 21.—Blow some particles of lime or charcoal into the hydrogen flame; the flame becomes visible and bright.

That the luminosity of a flame depends upon the presence of solid particles in it in a state of incandescence may be well illustrated by the following experiment:—

Experiment 22.—Take a U-shaped tube with a branch at the bottom. Fit two jets to the two upper openings of the tube and connect the hydrogen apparatus with the bottom opening of the tube. Pass hydrogen gas and light the gas as it issues from the two jets. Both the flames will be non-luminous. Now stop the gas; take away one of the jets and introduce a piece of cotton wool soaked in benzene into that limb of the U tube. Replace the jet and pass hydrogen gas again. On lighting the gas, it will be found to give a bright flame in the benzened jet, but the usual non-luminous flame will be seen in the other jet.

Benzene is a non-saturated volatile hydrocarbon, from which fine particles of carbon separate on burning. These, raised to a state of incandescence, impart luminosity to the flame.

When hydrogen burns in oxygen, the heat of the flame is very intense; there are few substances which can resist fusion at the temperature of an oxy-hydrogen flame. It is indeed capable of fusing platinum which is the most infusible of all metals. But the flame is scarcely visible, because there is an entire absence of solid particles in the flame. If by some means, we can bring this flame into contact with some solid infusible substance such as lime, the particles of lime will at once be raised to a state of incandescence by the intense heat of the oxy-hydrogen flame and the flame will thus emit an intensely dazzling white light which is known as lime-light and which is used in signalling stations and in light-houses, on account of its intense brightness.

Experiment 23.—Burn hydrogen in oxygen in the oxy-hydrogen jet and cause the flame to impinge upon a lime cylinder. Intense bright light will be produced.

We have hitherto studied combustion to be a chemical union between a combustible substance and oxygen of the air. Combustion may, however, take place in the absence of oxygen. In fact, any chemical union taking place between two substances neither of which is necessarily oxygen, the act being accompanied by the production of heat and light, may be called an act of combustion.

Take for instance the chemical union between phosphorus and chlorine; both of them are elementary substances; one is a yellowish-

white solid and the other is a greenish-yellow transparent gas. Whenever these two substances are brought together, they combine with great energy, and so much heat is developed that the phosphorus takes fire and white fumes of a compound of chlorine and phosphorus are formed.

Experiment 24.—Introduce a piece of phosphorus into a bottle of dry chlorine ; the phosphorus takes fire.

Here is an instance of combustion without oxygen. Another such instance may be furnished by the burning of particles of antimony when thrown into chlorine gas. Here also a chemical union takes place between antimony and chlorine and so much heat is produced that the particles of the metal take fire and produce a shower of sparks.

Experiment 25.—Throw some heated fine antimony powder into a bottle of dry chlorine gas.

Similarly, iodine and phosphorus when brought together unite with evolution of heat and light.

Experiment 26.—Bring a crystal of iodine into contact with a piece of yellow phosphorus on a porcelain plate ; the phosphorus will burst into flame.

Although ordinarily combustion is attended with the production of light, it is not so in all cases. Heat is always produced in the act of combustion, but light may be altogether absent in many cases. Our bodies may be considered as furnaces in which combustion is perpetually going on. The food we take in

and some of the tissues of the body are being continuously burnt by the oxygen which we inhale with the air in the act of inspiration. Heat is produced but not in such quantity as to ignite the combustible substances in the body. Our body-temperature is maintained by the heat produced from this source and part of it is converted into mechanical energy. A dead body is cold to the touch, because the dead man does not breathe and therefore no combustion takes place there and no heat is produced. Such combustion in which only moderate quantity of heat but no light is produced, is called *slow combustion*. But although the combustion is slow in our body, the products of the combustion are the same as of combustible substances burning outside the body.

All organic substances contain carbon and hydrogen, besides oxygen and a few other elementary substances which may be present in some of them. When carbon burns in air, the product is carbonic acid gas, and when hydrogen burns, the product is water. Wood, oil, coal, wax &c., all contain carbon and hydrogen ; when these substances are burnt in air or in oxygen, carbonic acid gas (CO_2) and water are produced as may be seen from the experiments to be shown presently.

The presence of CO_2 gas is detected by its behaviour with lime-water. If clear lime-water is mixed with carbonic acid gas, it becomes

milky owing to the production of an insoluble white substance known as carbonate of lime.

We have burnt charcoal in this bottle of oxygen and we must expect to find carbonic acid gas there. Let us pour some clear lime-water into the bottle and shake it well; you see the clear lime-water has turned milky, thereby proving that there was carbonic acid gas in the bottle which could only have been produced by the burning of charcoal in oxygen.

Experiment 27.—Pour some clear lime-water into the bottle in which charcoal has been burnt and shake well; the lime-water turns milky.

The same result will be obtained by pouring clear lime-water into the bottle of oxygen in which we have allowed the candle to burn. A candle contains carbon, hydrogen and oxygen; during combustion, its carbon combines with the oxygen of the air to form carbonic acid gas and its hydrogen forms water. Let us pour some clear lime-water into this bottle; you see the lime-water becomes milky at once as in the previous case, indicating the presence of carbonic acid gas in this bottle also.

Experiment 28.—Pour clear lime-water into the oxygen bottle in which the candle has been burnt. The lime-water turns miliky.

If we hold a dry glass tumbler over a burning candle, we find the inside of the tumbler soon covered with particles of water produced by the combustion of the hydrogen of the candle with the oxygen of the air.

Let us see whether the products of the slow combustion which is perpetually going on in our body are also carbonic acid gas and water. We inhale air which goes into our lungs and is absorbed by the blood circulating there; the oxygen of the air is carried by the blood to all parts of the body; union between this oxygen and the tissues of the body and the food we take occurs; the carbon and hydrogen of these substances are slowly burnt and the products are carbonic acid gas and water. These are carried back to the lungs by the returning current of blood and removed from the body by the act of expiration. A few simple experiments will show that this is really the case. If you blow air from your mouth on a piece of cold slate or on a mirror, you notice a cloudy film forms on the surface. This on examination is found to be minute particles of water which are always coming out with our breath but which cannot be ordinarily seen because of their being in the condition of vapour in the warmer expired air; but as soon as this vapour comes into contact with a cold surface, such as the slate or mirror, it at once condenses into minute particles of water which may be seen and touched. For the same reason, our breath becomes foggy in a cold December morning.

Let us see if carbonic acid gas is also formed in our body as the result of this slow combustion. Here is some clear lime-water

into which I shall allow the expired air from my lungs to pass by blowing through this glass tube. You will see the clear lime-water will become milky in no time.

Experiment 29.—Blow expired air into clear lime-water in test-tube ; the lime-water becomes milky.

You may naturally ask me if there is no carbonic acid gas in the air we breathe in. Yes, there is cabonic acid gas in the air no doubt, but its quantity is very small, only 4 parts in every 10,000 parts of air. Such a small quantity does not appreciably disturb the character of lime-water. The proportion of carbonic acid gas in the air we throw out from our lungs is, however, very much larger than this ; it has been estimated to be 100 times more than what is ordinarily present in the inspired air. Here is a simple apparatus to show you the difference in the proportions of carbonic acid gas in the inspired and expired air.

Experiment 30.—Place an equal quantity of clear lime-water in two flasks and fit them so with glass tubes that air may be breathed in through the lime-water contained in one of the flasks and breathed out through the lime-water contained in the other flask ; the lime-water in the latter will become milky, but in the former, it will remain practically unchanged.

We see from this experiment that air ordinarily contains a very small quantity of carbonic acid gas ; but the air that escapes from our lungs is enormously charged with CO_2 which is a poisonous gas.

Carbonic acid gas acts as a poison when breathed in, even in such proportion as ·1 per cent in the air.

Now, the quantity of carbonic acid gas constantly given off from our lungs is very large and if we add to it the CO_2 gas evolved by the combustion of fuel substances, such as coal, wood and oil which we have to burn for cooking our food and lighting our rooms and for various industrial operations, we can at once see how soon the air of a place becomes charged with this gas and rendered unfit for respiration. Such air when inhaled, not only lowers our health and makes us susceptible to attacks of diseases, but when present in sufficient proportion, may even produce death. In order to render such air fit for breathing again, the proportion of CO_2 must be reduced, and this can be done by allowing the poisoned air to mix freely with the outside pure air so as to get the quantity of the poisonous gas diluted to such extent as not to act injuriously on our health. This is effected by arranging proper ventilation of the room, so that by the admission of a large quantity of fresh air, the poisonous gas in the confined air of the room is much diluted and is also mechanically removed by the force of the air-current. You can see from this how important it is to keep the doors and windows of our rooms open at all hours of the day and night ; of course, precaution must be taken to

avoid draughts. Where a large number of people meet together, as in schools, hospitals, theatres, factories, and in meeting-halls, arrangements for proper ventilation must be made; otherwise people must suffer in health by breathing poisonous rebreathed-air again and again.

This excess of carbonic acid gas in the air is got rid of by a natural process. The green leaves of plants have the power of decomposing carbonic acid gas present in the air with the help of sun-light, retaining carbon for their own use and returning oxygen to the air again. The air is thus being constantly purified by this means during day-time and the process is known as *photo-synthesis*.

I think I ought to stop here as I have already exceeded my time-limit. If I had more time, I could have shown you by accurate experiments that the loss of substances by combustion, as when a candle is burnt away, is apparent only. There is no real loss of the substance of the candle in the act of burning; the constituents of the candle undergo transformation only and assume a condition in which they cannot be seen by the naked eye but the existence of which could be clearly demonstrated by chemical experiments. Matter can neither be created nor destroyed, and so is Energy also.

Before I sit down. I beg to thank Capt. J. A. Black M.A., M.B., I.M.S., Chemical Examiner to the Government of Bengal, for kindly looking over this paper and for permitting me to use his laboratory-apparatus for to-night's lecture. I have also to thank Babu Kunja Behari Seal for assisting me in the arrangement and performance of the experiments.

A Pinch of Common Salt.*

The subject-matter for to-day's lecture is a substance with which all of you are perfectly familiar. It is a substance which we daily use with our food; you may, therefore, naturally feel interested to know what kind of substance it is, whence it is obtained, and what its various uses are.

Varieties and Sources:—Common salt is chiefly obtained from sea-water which contains about 3 parts of this substance in solution in 100 parts of water. The sea-water is evaporated either by the direct application of heat, or more frequently by exposing it to the sun's rays in shallow vessels or trenches dug in the ground; the residue thus left contains the salt mixed with many impurities which are removed by suitable processes known as the "refining of the salt." A very large quantity of salt is prepared in India in this way in the sea-coast districts, chiefly in the Madras and Bombay Presidencies, in Orissa from the salt-water of the Chilka Lake, from the Sambar Lake in Rajputana, and from many marshy tracts situated in that province as well as in Sind. This product is known as *Karkach*. Some specimens of *Karkach* are of excellent quality; others contain

* A lecture delivered at the Calcutta University Institute on the 17th March 1906, on the occasion of the reception of mufussil Matriculation candidates.

mineral impurities from which the Liverpool salt is practically free. Much salt is also prepared in this way in Portugal and in countries bordering the Mediterranean sea.

There is another kind of common salt called *rock-salt* which exists in vast underground deposits in the Punjab, in Sind and in the North-Western frontiers of India. It is largely consumed by orthodox Hindus in place of the Liverpool Salt. It is called *saindhab* in this country; its supply is considered inexhaustible and its quality excellent. It is generally obtained from these mines by quarrying. It is probable that the places where the deposit occurs formed in by-gone times part of a sea which has subsequently been filled up and converted into land.

Vast deposits of *rock-salt* occur in Cheshire and in a few other places in England and Ireland. It is obtained either by quarrying or by admitting fresh water into these strata when it dissolves the salt and forms the "brine." Iron shafts are sunk into these mines for the collection of the 'brine' which is pumped up and evaporated in shallow vessels, heat being applied from below. The Liverpool salt is prepared in this way.

The third kind of salt, the manufacture of which has now been prohibited all over British India except in a few Feudatory States, is known under the name of earth-salt or *Panga*. There are many tracts in India the soil of which

is impregnated with common salt. The soil is either dissolved in water, or deep wells are sunk in such soil where the brine collects. It is evaporated by artificial heat and the residue thus obtained is used as common salt. It is, however, so very impure that its prolonged use is sure to impair health and cause sickness. Moreover illicit manufacture of this kind of salt cannot be effectually controlled without much loss of Government revenue; so its manufacture has been proscribed by law.

Salt is also found mixed with other saline substances as an efflorescence on land in certain parts of India. This salt is named *Reh salt*.

Besides these varieties, there are a few special kinds of salt called *beet laban* and *kala nimak* which appear to be mixtures of various kinds of saline substances; these are used as medicine in the Hindu system of medicine.

Composition:—Common salt is a *compound* substance made up of two *simple* substances called *sodium* and *chlorine*. I ought to explain to you here the difference between a *simple* and a *compound* substance. All substances that we see, feel or recognise by means of our senses may be divided into two great classes, *simple* and *compound*. *Simple* substances are those which cannot be split up into simpler forms by physical or chemical agencies; they, therefore, consist of one kind of matter only. The familiar examples of simple substances are gold, silver, iron, copper, sulphur, mercury,

sodium, phosphorus, oxygen, hydrogen, nitrogen chlorine, etc. Up to the present time, 82 such substances are known to us including several additions to the list made during recent years, and it is certain many more additions will be made in future years. Most of these substances are solid, such, as gold silver, sulphur, sodium &c.; two are liquid, such as mercury and bromine; and a few, such as oxygen, hydrogen, nitrogen, chlorine &c., exist in the gaseous form. Simple substances are commonly known as *Elements*.

Compound substances are those which can be split up into two or more *simple* substances by physical or chemical agencies. Their number is unlimited; in fact, almost all things that exist around us are substances of this nature and they can be split up into two or more elementary substances by heat, by electricity or by chemical means. For instance, water, which more than 100 years ago was considered to be a simple substance has been found to be a compound substance made up by the chemical union of two simple substances—oxygen and hydrogen; for if you pass an electric current through water, it will at once be split up into these two gases. Let us take another compound substance, *e.g.*, chlorate of potash ($KClO_3$) with which I am sure many of you are familiar, as it forms an ingredient of many fire-work compositions. This substance is made up of three simple substances, namely, potassium, chlorine

and oxygen. When it is heated, it is split up and gives off oxygen which is recognized by its power of re-kindling a glowing chip of wood when brought into contact with it.

Exp. (1) :—Heat $KClO_3$ in a *test-tube* and introduce a glowing chip of wood ; it bursts into a flame.

Mercuric oxide (HgO) is another compound substance which is decomposed on being heated into mercury and oxygen.

Exp. (2) :—Heat HgO in a test-tube and test for O in the way described in the first experiment.

Now, common salt is also a compound substance formed by the chemical union of two simple substances, namely sodium (Na) and chlorine (Cl). By means of electricity, you can split up common salt into these two substances. Before I proceed to show you the splitting up of common salt by means of electricity, I ought to tell you the tests by which sodium and chlorine which compose the common salt may be recognised. Sodium when brought into contact with water decomposes it and forms an alkaline solution which turns red on the addition of a certain chemical reagent (phenolphthallin). Let us throw a piece of sodium on water and see if we get the reaction just described.

Exp. (3) :—Throw a small piece of sodium on water contained in a small capsule ; when the sodium disappears, pour a little of the water into a test-tube and add a few drops of an alcoholic solution of phenolphthallin ; the solution will turn red.

We shall apply this test to sodium obtained by the decomposition of common salt by means of electricity.

The next thing is to determine what test we should apply to detect the presence of chlorine which is the other constituent of common salt. If a solution of chlorine in water is mixed with a solution of iodide of potassium and starch, a dark-blue compound is formed and this re-action enables us to detect the presence of chlorine.

Exp. (4) :—Take a solution of potassium iodide, mix it with starch-paste and then add chlorine water ; the solution turns dark-blue.

We shall also apply this test to detect the presence of chlorine in common salt.

Let us see if we can decompose common salt into sodium and chlorine by means of electricity.

Here is a V-shaped tube in which we have placed a solution of common salt in water. We have placed a piece of metal called platinum in the solution in each limb of the tube and we are going to connect these pieces of platiumn with the two ends of an electric battery. As the electric current will pass through the solution, the common salt contained in the solution will be decomposed into chlorine and sodium. Sodium will collect at the negative pole of the battery and chlorine at the positive pole. We have put a small quantity of a mixture of iodide of potassium and starch into the limb of the V-shaped tube connected with the positive pole, and a little phenolphthallin into the other limb which is connected with the negative pole.

You see the solution in each of the two limbs is perfectly colourless now, but as soon as the current will be passed, common salt will be decomposed, sodium will collect at the negative end and colour the solution red; and chlorine gas will collect at the positive end and colour the solution deep-blue.

Exp. (5) :—Take a V-shaped tube filled with a strong solution of common salt; put phenolphthallin solution into one limb and a mixture of iodide of potassium and starch-paste in the other limb; connect the tube with the battery. The solution becomes red at the negative end and deep-blue at the positive end.

Thus you see that common salt is a compound substance which we have split up into two simple substances namely sodium and chlorine. Common salt is, therefore, chemically called sodium chloride.

Let us now briefly study the properties of the two elements which combine to form common salt.

First of all, let us take sodium.

Properties of Sodium.—Sodium is a solid metal, of a bluish-white color, quite soft so that it may be cut into pieces with a knife. It has great affinity for oxygen, so that it can neither be kept exposed to air nor in water; it must be kept in something which contains no oxygen. The fluid which you see in this bottle and in which we have kept the sodium is called naphtha which belongs to the same class of substances as kerosine oil which contains carbon and hydrogen only but no oxygen. Sodium

has so great a tendency to combine with oxygen that when thrown upon water, it decomposes the water, combining with the oxygen and liberating hydrogen. The metal moves on the surface of the water with a hissing noise.

Exp. (6) :—Throw a piece of sodium on water contained in a porcelain capsule.

If we can confine the movement of the metal, hydrogen is given off at one place only and it may be collected in a vessel by displacement of water.

Exp. (7) :—Put a piece of sodium within a wire-gauze cage and place it in water under the mouth of a test-tube which is also filled with water and placed in it with its mouth downwards. Hydrogen will be given off in bubbles which will collect in the test-tube. Raise the test-tube and apply a light to its mouth in the inverted position; a sound is produced and hydrogen burns with a non-luminous flame.

Hydrogen is an invisible gas which in contact with air explodes when a light is applied to it and burns with a scarcely visible flame. The gas produced by the action of sodium on water answers these tests; it is, therefore, hydrogen.

If sodium is placed on hot water, or if its movement is restricted even in cold water, the hydrogen liberated takes fire and burns owing to great heat developed by the chemical action.

Exp. (8) :—Throw a piece of sodium on hot water; hydrogen burns.

Exp. (9) :—Float a piece of blotting paper on cold water and place a piece of sodium on it; the hydrogen liberated will take fire.

Let us now consider the properties of the other simple substance which enters into the composition of common salt, namely *chlorine*.

Properties of Chlorine.—Chlorine is a gas of a greenish-yellow colour and transparent. It possesses a very strong irritating odour, so that if the strong *gas* is inhaled, it produces violent cough and difficulty of breathing and causes inflammation of the air-passages and may even produce death. Therefore you must be careful not to smell strong chlorine. When much diluted with air, it is given as an inhalation in certain diseases. It is soluble in water and the solution is called *chlorine-water* which we use in the laboratory as a reagent. The gas is $2\frac{1}{2}$ times heavier than air. Chlorine has great affinity for certain simple substances, such as phosphorus, antimony, hydrogen etc. When brought into contact with any of these substances, it combines with it with very great energy, and so much heat is developed that the substance takes fire.

Exp. (10).—Introduce a piece of phosphorus in a deflagrating spoon in chlorine gas; the phosphorus burns and white fumes of a compound substance called phosphorous chloride are formed.

Exp. (11):—Throw some heated antimony powder in a bottle of chlorine gas; the particles take fire and white fumes of antimony chloride are formed in the bottle.

If hydrogen and chlorine are mixed together in a flask and the flask is well-corked and exposed to direct sunlight, the two gases combine to form hydrochloric acid with explosive violence. The two gases, however, do not combine in the dark and they combine only slowly when exposed to diffused sunlight.

The affinity of chlorine for hydrogen is so great that it is able to wrench this element from many substances which contain it. Turpentine is such a substance; it is made up of carbon and hydrogen; now if you bring turpentine into contact with chlorine gas, chlorine will forcibly take away the hydrogen from turpentine to form hydrochloric acid and leave carbon in the form of soot. So much heat is developed by the chemical action that if turpentine is poured upon a piece of paper and then introduced into chlorine gas, the paper will burn.

Exp. (12):—Put a few drops of dry turpentine on a piece of filter paper and introduce it into a bottle of chlorine gas. The paper will burn and the bottle will be filled up with fumes of hydrochloric acid and soot.

Chlorine has got another important property for which it is largely used in the arts. It can bleach or destroy vegetable colours. Cloth when first made has a dirty brownish colour; if the cloth is moistened with water and then exposed to chlorine gas, it becomes white. The pure white cloth that we use is prepared in this way. Paper is also bleached in the same way. Rag, grass, and other materials which are used for making paper would produce dirty-brown paper if not bleached by chlorine; the dirty-looking pulp made from these substances is subjected to the action of chlorine when the pulp becomes perfectly white and yields milky-white paper. Instead of the chlorine gas, a compound of chlorine, called *bleaching powder*, is used for this purpose.

I can show you the action of chlorine on a vegetable colour by introducing a red flower into this bottle of chlorine gas. You will find that after a short time, the red colour will be destroyed.

Chlorine can bleach vegetable colors in presence of moisture only; therefore the substance to be bleached must be wetted with water before it is put into chlorine gas.

Exp. (13) :—Introduce a red *Jaba* flower (wetted with water) into a bottle of chlorine gas; after a short time, the red color will be discharged and the flower will look pale yellowish-white.

Chlorine has no action on mineral colour; writing ink which is a vegetable colour is bleached by chlorine, but printing ink which contains a mineral pigment is not affected by chlorine.

Exp. (14) :—Introduce a piece of paper with some writing on it in writing ink, and another piece of printed paper into a bottle of chlorine, both being wetted with water. The writing ink is bleached, but the printing ink remains intact.

I have already told you that chlorine is largely used in the arts for its bleaching properties. Owing to the irritant nature of the gas, it becomes a source of trouble and danger when thus used.

It is, therefore, replaced by one of its compounds called *bleaching powder* which is prepared by passing chlorine gas through slaked lime. It is a much milder substance and gives chlorine only when acted upon by an acid. The substance to be bleached is first dipped into a

mixture of bleaching powder and water and then put into some dilute acid. The acid liberates chlorine from the bleaching powder which attacks the vegetable colour and destroys it.

Chlorine is not used for bleaching silken and woolen fabrics, as the gas exerts a corrosive action on such materials. Chlorine is used for bleaching cotton and linen fabrics.

A very important branch of industry, called *calico-printing*, is dependant upon this bleaching property of chlorine. Calico-printing is the art of producing white patterns on coloured cloth. The cloth is dyed red with turkey-red which is a vegetable colour or with some other kind of vegetable colour and then patterns of diverse descriptions are imprinted on the cloth with an acid pasty material called the "*discharge*"; when dry, the cloth is put into a watery solution of bleaching powder. By this means, chlorine is evolved in those portions of the cloth which contain the acid paste and the colour in these portions only becomes discharged, leaving the patterns as white spots on the general coloured ground.

On a small scale, I can show you the art of calico-printing. Here is a piece of red cloth on which I have drawn some designs with the acid pasty "*discharge*." If I now dip it into this watery solution of bleaching powder, the colour from those spots on which the designs have been made with the acid paste will be discharged;

but the colour of the cloth in other parts will remain in tact, because there is no acid in those parts to evolve chlorine from the bleaching powder. The designs will thus come out in white on red ground.

Exp. (*14*) :—Print some designs with a paste of tartaric acid and gum on a piece of turkey-red cloth and put the piece of cloth into a mixture of bleaching powder and water ; after a short time, take out the piece of cloth and wash it with water ; the designs will come out in white on red ground.

Chlorine has another very important property for which it is largely used in sanitary science. It is a great disinfectant, and it also destroys bad odours. It is used to purify the air of sick rooms and to disinfect the clothes and bedding of patients suffering from contagious and infectious diseases.

It is hardly necessary to describe the physical properties of common salt with which you are quite familiar. I shall conclude my lecture with a few observations as to the *uses* of common salt.

Uses :—(1) Common salt is a constituent of blood and other fluids in our body in which a proper proportion should be maintained for the preservation of health. It is constantly passing out of the body in the sweat, urine, and other discharges, so the loss must be made up by supply from outside. If we live upon milk or roasted meat only as people used to do in nomadic life, we do not require any salt with our food ; but in civilized life when we take

mixed and cooked food, some salt must be added to the food to make up deficiency and for the loss caused by boiling. Almost all our food articles contain a certain amount of common salt but the amount is not always sufficient and, therefore, we have to take an extra quantity of salt with our food, especially in India where most people live upon cereals, pulses and vegetables. The same remarks apply in the case of the lower animals and we must add some salt to the food we give to our horses, cattle and other domestic animals. Salt is considered to be such an important factor in our diet that there is a well-known Indian proverb which says that one who eats the salt of another must not prove unfaithful to him. *Nimakharam* is probably the strongest abuse which one man can level against another in this country.

(2) Salt is also used for many agricultural operations.

(3) Salt is largely used for the preparation of many chemicals and useful articles of domestic economy. For example, hydrochloric acid, chlorine and bleaching powder are all prepared from common salt. Chloride of silver, so important in photography, is obtained by the action of common salt on silver nitrate. Carbonate of Soda so largely used for the manufacture of caustic soda and glass, is obtained from common salt by Leblanc's process. Common salt is also used in the preparation of soap and in the manufacture of pottery.

(4) Common salt has a preservative action and is largely used for the preservation of fish, meat, butter, cheese and many other articles of food. Salted fish is largely consumed in the Eastern districts of Bengal. Salt is also largely used to preserve hides sent out from India into foreign countries. Saturated solution of common salt is used to preserve cattle-visera sent for examination to the Chamical Examiner's Department in cattle-poisoning cases and in certain cases of human poisoning also.

(5) And lastly, common salt is also used in medicine. It is given with warm water to produce vomiting in poisoning cases, and also as an injection into the rectum to kill thread-worms. Solution of common salt of certain strength is largely used to intravenously and by the rectum in the treatment of cholera and other diseases. *Saindhab*, *beet* and the black salt are used by Kabirajes as medicine in various forms of digestive disorders. The free use of salt is believed by some people to give protection against plague.

MISCELLANEOUS

Marriage-Dowry *

I propose to deal with a question of vital importance affecting the well-being of our society, which, I am sure, will readily enlist your sympathy and interest. It is the marriage-dowry question which is much agitating the public mind at the present moment, intensified by the self-immolation of a Hindu girl of tender age under very distressing circumstances. As you all know, gentlemen, the girl (Snehalata) burnt herself to death to save the family from impending ruin in consequence of an exhorbitant demand of dowry at her proposed marriage. This is only one instance among many of misery brought upon respectable but poor families by reason of extortionate demands they have to meet at the time of their daughters' marriage. And if it cost the life of the bride in the present case, it had before, to my knowledge, been responsible for the self-destruction of not a few fathers having no means to marry their grown-up daughters, and of many a young married girl unable to bear persecution in their father-in-law's house for non-payment of the promised dowry. If it had not been for the fact that our girls are married at too early an age to understand

* The Modern Review, June, 1914

the desperate position of their parents, such sad instances of self-immolation of our girls would have been more frequent. In the present case, the unfortunate girl was sufficiently grown up to realise the difficult position of her father aud she voluntarily put an end to her life to save the family from embarrassment and humiliation.

It must not be supposed, however, that the Bengali community alone suffers from the evil effects of this pernicious custom. It is prevalent more or less in all communities, Indian and European, but it may be stated without fear of contradiction that it is nowhere carried on with that shameless effrontry as among the Hindus in Bengal. English parents know that they have to set apart something in the shape of a dowry in marrying their daughters, but the transaction is relieved of its ugly features in being always an apparently voluntary contribution on their part. It may be that in a few cases, some unprincipled persons back out even after engagement when, by some unexpected turn of events, the expected settlement on the bride fails. But such cases are rare in English society. The fact of men marrying when they are competent to support a family, and also that of the parties choosing one another from considerations of love and mutual good understanding, do not permit the question of dowry to stand between their union.

The Mahommedan society is not altogether free from the influence of this baneful custom. A very leading organ of the Mahommedans, the *Musalman*, writing recently on the subject of commercial matrimony, observed that although their Hindu countrymen were the greatest sinners in this matter, it was to them a matter of extreme regret that the Musalmans too had begun to follow the evil example of their Hindu brethren, and the case of Snehalata was cited as a warning to both the Hindus and the Mahommedans against the continuance of the practice.

The Beharee Hindus are also victims of this evil custom. Only the other day, the *Mithila Mihir* exhorted the Maithil community to refrain from demanding dowries, which practice, the paper said, was alarmingly on the increase. In the last Census Report, it is noted that "the price of a Beharee B.A., husband has been known to run up to Rs. 3500," and with reference to the Bengalis, the same Report states that "the price of a Kayastha Matriculate or Graduate usually varies from Rs. 500 to Rs. 3000, but there are instances of Rs. 10,000 being demanded and paid." We who are familiar with the actual condition of our society must have to admit that this is rather an under than an over-estimate. We ought to hang down our heads in shame at this exposure of a national weakness. The Census Report of British India, being an interesting and valuable docu-

ment, is widely read all over the world. Is it not our bounden duty to try to clear our national character of this just but most humiliating reproach as soon as possible, so that the Officer in charge of the next Census Report will find no opportunity to hold us up to ridicule in the eyes of the whole world?

The present practice of fleecing the fathers of girls is of comparatively recent growth. I remember certain marriages contracted about 35 or 40 years ago in which the parents of bridegrooms insisted upon receiving a certain sum in cash and ornaments from the bride's party as dowry. But then the demand was usually moderate and the practice was confined to a comparatively small section of the community. The aristocratic families seldom made any such stipulation, and be it said to the credit of some of them that they still decline to receive cash or to make any contract as regards dowry at the marriage of their sons. It is among the rising middle class deople who have themselves received good education and are giving University education to their children, from whom in virtue of their enlightenment we expect much better things, that the evil practice most prevails.

The practice of selling sons at the marriage-market was preceded for a long time by that of selling daughters among certain classes of Brahmins and Kayasthas in Bengal. Many Kulin girls used to remain

unmarried up to an advanced age because bridegrooms able to pay the stipulated price, were not readily forthcoming. The custom is still prevalent among some of the lower castes of the Hindu community. You will find men of the servant-class remaining single for a long time for want of means to buy their wives. In Cooch-Behar and in Orissa, among certain classes, they have to buy wives and the price of the bride is said to be still rising up.

In Bengal, the tables are now turned, and instead of buying wives, we have to buy husbands for our daughters. It has grown into a regular trade and the price fluctuates according to the laws of demand and supply in the marriage-market. Sons are offered to the highest bidder and the keen competition to obtain the most eligible son-in-law often causes the price to go up to fabulous figures. Matters have thus come to a crisis and many a respectable family of limited means, unfortunately burdened with a large number of daughers, has been rendered homeless and reduced to utter destitution by payment of extortionate marriage-dowries. There is so much reversal of natural feeling owing to this cause that the birth of a daughter in many Hindu families is looked upon as a calamity and the usual welcome of the first advent of a child in a Hindu house by the blowing of conchshells is denied to poor daughters. If a

daughter dies before her marriage, the parents, in spite of their grief, feel somewhat relieved. By this I do not mean that the parents do not do their best for the proper treatment of the girl during her illness but it cannot be denied that her death at that period of life is regarded in families of limited means as not an unmixed evil. It must be admitted that such cruel change in natural feeling is most detrimental to the moral advancement of our community and it is high time that strenuous efforts should be made to eradicate the evil and save the community from moral degradation and misery.

In seeking for a remedy, the causes which give rise to this evil must first be found out. Unless these are known, no successful measures could be adopted to strike at the root of the evil.

There are more causes than one which account for the existence and growth of this baneful custom in our community. The evil is our own creation. For, unlike other social customs, it receives no sanction from our Sastras. On the countrary, commercial matrimony has been condemned in no measured terms in all our religious books. It must be acknowledged with a sense of shame that the evil practice has grown in the country with the advent and progress of University education, and that the Brahmins and the Kayasthas of Bengal, among whom University education is most advanced, are the greatest

culprits in this respect. It is very strange that it should be so, but it is nevertheless a fact that the University degrees are largely responsible for the growth and perpetuation of this custom in our society. And as education is penetrating into other less advanced castes, they are insensibly falling victims to the evil practice. This is in consequence of our unfortunately imbibing only the mercenary spirit of the Western system of education without profiting by its higher and nobler aims.

One of the causes of the evil lies in the altered standard in the selection of our bridegrooms. Two generations ago, the standard of eligibility rested mainly on family-considerations. The respectability and the social status of the family were the principal factors in the selection of bridegrooms. And if in addition to this, the bridegroom-elect was found to be a man of some education and free from the predominating vices of the age, he was considered to be a very suitable candidate. The question of high education never troubled our fore-fathers in making the selection, as people had not then so much to depend upon high education as a means of earning a livelihood. The struggle for existence had not then grown so acute; every family had some landed property which yielded sufficient income in money or in kind to meet the absolute necessaries of life. Our wants then were few; our grandfathers and grandmothers were strong

able-bodied men and women who did not require to keep expensive servants to do the domestic work. The expenses on education were trifling; and most people remained satisfied with simple food, simple clothes and simple household furniture. They needed no hired cooks to spoil their appetite; they required no liveried servants to scare away beggars from their doors. Dyspepsia and hysteria were then comparatively unknown diseases, and the ladies of the house, young and old, never looked upon the performance of domestic duties as a drudgery or as humiliating and derogatory to their sense of dignity. The small income of the family was sufficient to provide for its simple wants and the people remained content with what they had. The desire for gain and love of luxury and the pride of show did not trouble most people then. In this state of society, fathers were quite satisfied if they could marry their daughters to young men of good families free from social vices, and bred and brought up in the orthodox faith and style.

The standard of eligibility has undergone a radical change in the age in which we live. The status of the family, its religious proclivity, its moral atmosphere, are now considered factors of minor importance in the selection of bridegrooms. Respectability now consists either in being a Government Servant or belonging to one of the learned professions, and as University

degrees are the passports to them, undue importance is naturally attached to these degrees. The number of University "passes" determines the position of a bridegroom in the marriage-market. A young man of respectable family earning a modest income from the soil or from some humble trade but who has not passed the Matriculation examination of the Calcutta University is hardly considered a suitable match for the daughter of a clerk not earning more than Rs. 50 a month in a Government office. He must have a graduate, or at least a College student for his son-in-law, even if the young man has to depend upon his relations and friends for help to defray the expenses of his education. But if in addition to the possession of University degrees, the young man's father happens to be a pleader, a doctor or a member of the Subordinate Judicial or Executive service, the position of the bridegroom in the marriage-market becomes a most enviable one and the fathers of marriageable daughters try to secure him at any cost.

Under such circumstances, is it any wonder that the price of the bridegroom would go on increasing in the marriage-market? The number of bridegrooms having such qualifications is not usually very large, specially as we are rigidly bound down by caste-rules and cannot go beyond a certain number of families within one's own caste for entering into matrimonial

alliance. For every such eligible bridegroom, there are fifty or more fathers throwing baits for their capture. The match-makers vie with one another in making increased offers of dowry, and the father of the bridegroom must be more than human if he could resist the temptation of selling his son to the highest bidder.

The predominating but erroneous idea of women being inferior to men indirectly helps this evil practice to continue in our society by undervaluing the worth of our girls in the marriage-market; and public opinion should be educated to appreciate the full worth of our women in the social organisation. This is not too much to expect from a nation which worships its unmarried girls (*Kumari Poojah*) as being the emblems of the creative force of Nature. We have so much fallen from this high ideal of womanhood that we now demand a dowry as compensation for her supposed inferior worth. In family life, the husband and the wife each contributes his or her share in making it complete and happy. If it is the duty of the husband to earn money, it is no less an arduous duty of the wife to build up the beautiful structure of a happy home where order, comfort and peace reign supreme. Thus the importance of the husband in the social organisation cannot be considered superior to that of the wife. When this is fully realised by the men of our community,

the position of the women will be improved; they will be treated with greater respect and consideration, and they will cease to be disposed of at the marriage-market at a discount. Their worth will be considerably enhanced by giving them proper education and training, but this can not be satisfactorily accomplished unless we raise their age of marriage, thus allowing them longer time for the completion of their education than is possible under the existing circumstances.

The compulsory marriage of our daughters before a certain age is the principal factor which helps this evil custom to persist and grow in our society. Every Hindu must marry his daughter before she attains puberty, as otherwise he becomes subject to the opprobrium of the community in which he lives. A certain amount of difficulty has also to be faced in marrying a girl after puberty in orthodox Hindu society. It is a great pity that the educated community should feel bound to obey certain injunctions of the Sastras which are opposed alike to reason, to laws of health and to the findings of Science. Certain ancient Hindu law-givers have laid it down that if a girl attains her puberty before her marriage, her ancestors suffer cruel punishment in the spirit-world on this account. I am confident that no educated Hindu believes that this is anything but a threat to force ignorant people to bow down to a custom

which, for reasons not known to us, might have suited the stage of the society at the time of passing these laws. But society is a living organism, and as such, must undergo evolution, and laws must be changed to suit its altered condition in different ages. Unless this is done, stagnation occurs, all growth and development cease, society gradually becomes more and more devitalized, and ultimately all signs of life become extinct. This is a law of Nature which must assert itself above all laws made by man. When we follow the Sastric rulings in this particular case, it is not that we place any faith in these injunctions, but that we are afraid to go against the custom for fear of social opposition and persecution. What, therefore, we really want is moral courage to stand by the truth and follow the dictates of our conscience, and not sacrifice it at the altar of expediency. There could be no graver charge against the educated community than this, but it is all the same a true charge and it is high time we should adopt a line of conduct in every way worthy of our noble traditions, our education and our enlightenment. It is significant that some of the most learned Pundits of Bengal declared the other day at a meeting held in Calcutta that the Hindu Sastras do not object to late marriage in the case of girls under all conditions, and they cited the case of Kulin Brahmins marrying their daughters at a much advanced age without

suffering social indignity and without any fear of bringing the spirits of their ancestors to grief by their heterodox action. If it is allowable in the case of Kulin Brahmins, there is no reason why the penalty should touch the other sections of the community, and I sincerely hope that this important declaration of the Pundits will have a far-reaching influence for good in our community.

This compulsory marriage of daughters before a certain age makes their fathers unwilling victims to extortionate demands. If the age-limit of marriage in the case of our girls is done away with, their fathers could wait and resist the unfair demands of the other party. The abolition of the early marriage of girls would thus directly help in the dissolution of this custom. It was held by certain leading members of the orthodox community who met the other day at Calcutta to discuss the Early Marriage question, that the raising of the marriage-age of boys is responsible for the growth of this pernicious custom (dowry system), and they recommended a return to the old state of things, *viz.*, of marrying boys at an early age, as a remedy for this evil. The reactionary spirit of this proposal cannot be too deeply deplored. Happily, the advantage of marrying our young men at a little advanced age from educational and economic considerations is being recognised by most of us in Bengal and we are not likely to be influenced by the backward notions of

these well-meaning but mistaken defendants of orthodoxy. The *Statesman* of the 18th February last commenting on the proceedings of this meeting wrote as follows :—

"At a meeting held under the presidency of Mr. Saroda Charan Mitra and addressed by Sir Gooroo Das Banerjee and other orthodox Hindoos, the view was propounded that the rise in the price of bridegrooms was due to the tendency to postpone the marriage of boys, and it was solemnly urged that the remedy for the situation was that the young men should marry at an earlier age. Happily, there is no reason to suppose that these obscurantist notions will have the slightest effect on the sensible and salutary advances in the age at which young Bengalis enter into the responsibilities of marriage. Experience has shown that if a boy is to do justice to himself during his educational career, he should be free from matrimonial cares and burdens, and the practical benefits of postponing marriage have been so obvious that the age is likely to become still later as time goes on. Against the indubitable advantage of this delay, the champions of orthodoxy will strive in vain."

I believe that the view taken by the *Statesman* is the view of the majority of my educated countrymen in Bengal.

Even admitting that "since girls must by usage be married before a certain age while boys are free to marry much later, the supply of available husbands naturally falls below the demand and the fathers of boys can ask their own price", the "Statesman" hoped that "the effect of Snehalata's martyrdom would not be so much to cause the fathers of sons to abate their prices as to induce the fathers of daughters to postpone their marriage. When the marriage-age of girls is advanced in the same proportion as that of young men, an equilibrium will be established between supply

and demand and the Bengali people will then be gainers, since their racial development will no longer be sapped by premature marriage and motherhood". We hope that the soundness of this view will be widely appreciated and that practical effect be given to it at once, so as not only to put an effective check on extortionate demands but prepare the way for the nation to attain to a vigorous manhood by the abolition of early marriage of both boys and girls.

According to the highest medical authorities, Indian and European, ancient and modern, a girl is not fit to become a mother before she attains at least the age of 16. Sushruta has authoritatively laid down that if a child is conceived before the father is 25 and the mother 16, it is likely to die in the womb, or if it is born, it dies prematurely, or if it lives, it becomes subject to lifelong illness.

ऊनषोड़शवर्षायाम् अप्राप्तपञ्चविंशतिं।
यदाधत्ते पुमान् गर्भं कुक्षिस्थः स विपद्यते॥
जातो वा न चिरं जीवेत् जीवेद्वा दुर्बलेन्द्रियः।
तस्मादत्यन्तबालायां गर्भाधानं न कारयेत्॥

Now, it cannot be denied that as soon as we marry our girls, they become exposed to all the risks of motherhood. It, therefore, stands to reason that they should be married only when

they are fit to become mothers. Sixteen should, therefore, be the minimum age of marriage of our girls. But considering the extremely conservative character of the Hindu society, to make any reform-movement acceptable and successful, we must proceed cautiously and along the line of least resistance. For the present, therefore, if we fix fourteen to be the minimum age of marriage, we may hope to see it raised to the desired minimum (16) before long, or even above it, as is the case in the Brahmo community.

Some people apprehend that the deferred marriage of our girls might lead to grave social abuses. I do not think there is any ground for such apprehension so long as we preserve the integrity of our social life, so long as we do not encourage free intercourse between youthful members of the opposite sexes, so long as we keep our girls engaged in education and other useful occupations, and so long as we exercise a healthy moral control over our household by precept and example. We need expect nothing but good following the introduction of such a salutary social reform.

There is another difficulty in the way of suppressing the dowry-evil. In former times, the fact of a girl belonging to a high caste family went far in favour of her selection as a daughter-in-law. It was considered to be a proud privilege and honour in many Kayastha families to be able to secure a girl of high Kulin

descent for a daughter-in-law. Even dark-skinned Kulin girls were considered precious prizes and were treated with great respect and consideration in the family of their father-in-law. Now-a-days, however, cosiderations of pedigree have given place to commercial stipulations. Most people are now quite indifferent as to the antecedents of the family, from which the daughter-in-law comes, provided that she brings with her casketfuls of jewellery and bagfuls of cash-money. Those few that are not particular about dowries insist upon having paragons of beauty for their daughter-in-law. An inevitable consequence of this is that the father of a dark-skinned girl has to pay a high price for the crime of her colour, as otherwise no one would select her in preference to her more fortunate fair sister. This can to some extent be remedied by changing the standard by which selection of brides is made in our society. At present, our young men have no voice in the selection of their wives. If that had been possible, the solution of the dowry-problem would have been made somewhat easier. But for a long time to come, the selection would remain in the hands of parents, and from many important considerations it is desirable that it should remain so. The parents are generally men of education and of mature age and judgment, and so long as the selection remains in their hands, one would expect that it should

be based on educational, moral, and social considerations only. If we had not hitherto followed these sound lines, if our sense of duty had so long slept over the matter, let us not allow it to slumber any longer. Let us rise above all selfish considerations and discharge our duties as parents in the light of the best traditions of our ancient civilisation and our modern education and culture. I sincerely hope that the parents of boys would adopt such a standard for selecting their daughters-in-law. We now fully recognise that unless our women are properly educated, they can not make good wives, good mothers, good house-wifes and worthy members of the community. There is a wide-spread awakening in the country for the spread of female education among all sections of the community. Let us base our selection of our future daughter-in-law, not on fair skin or any pecuniary consideration but on the antecedents and moral surroundings of her family, her education, her personal and social virtues, her health and her accomplishments. Such a girl would be an ornament in any home that she comes to live in, and this ought to out-weigh all other considerations. If such a standard is adopted, it would act as a great impetus to the spread of female education in the country. Fathers of girls would then take special care to give them good education and training, as that would constitute the best marriage-dowry in

the market. To attain this object, the present marriage-age of girls must be raised in order to allow them sufficient time to complete their education. By education, I do not mean the exact type of education which our girls are now receiving in many of the schools and colleges in Calcutta. I strongly hold the view that our girls should receive a different kind of education from that of our boys. They should receive such education as will help them in developing their womanhood and will enable them to successfully discharge the responsible duties of motherhood and to acquire competence in the management of homes which will always be their chief sphere of action. The higher education imparted by our University is unsuitable to the majority of our girls. There is not enough time for them to finish such education; then, it does not quite fit them for their home-life; the strain on the constitution is excessive and it often cruelly tells upon their health. In a very thoughtful paper contributed to the Falgoon number of the *Prabasi* by Mrs. K. B. Das, the worthy Secretary to the Bharat Stri Mahamandal (which is doing so much for the spread of education in orthodox homes in Calcutta), the learned writer aptly describes the kind of education imparted to our girls in our public schools as fit for the drawing-room only; it has failed to develop their womanhood. The Lord Bishop of Calcutta at the last distribution

of prizes of the Diocesan Girls' School is stated to have observed that the system of education of Indian girls on purely Western lines would never succeed. His Lordship also said that we need not go outside India to teach Indian women ideal characters. There are examples of Indian women who are matchless in piety, in purity and strength of character and in devotion to duty, and the education of Indian girls would be successful if they only followed these as their ideals. It is not my purpose to enter into the discussion of this question in the present paper. The matter should engage the serious attention of all thoughtful people who have the welfare of our society at heart.

Another means to minimise the evil is to relax the inter-caste rules of marriage and make the area of selection as wide as possible. By relaxation of inter-caste marriage-rules, I do not mean that marriage should take place between the members of the four principal castes, viz., Brahmins, Khatriyas or Kayasthas, Vaisyas and Sudras. In the orthodox society, this will not come to happen in the near future. What I mean is that there ought not to be any difficulty in marriage taking place between the various sub-sections of each caste. In this matter, I am only asking you to proced on the line of least resistance. There is no reason why a Dakshinrarhi Kayastha should not marry into a family of Uttarrahi or Bangaj Kayastha; the separation here is only artificial, effected

by long residence in different parts of the country, these different sections having a common origin. Similarly, I do not see why a Rarhi Brahmin should not be united by matrimonial alliance with one belonging to the Barendra or Baidik section. The *Kayastha Mouliks* can not at present marry their sons or daughters in any other but the three *Kulin* families only. They consequently labour under very great hardship owing to this extremely narrow field of selection, they themselves constituting 80 or more different families. There is no reason why there should not be intermarriage between the *Mouliks* themselves. By this, the area of selection would considerably extend, and the fathers of girls would not have to submit to the price fixed by the bridegroom's party. A movement has been set on foot in this direction by the *Kayastha Sabha* of Calcutta but the progress made up to this time has been very slow indeed. A similar movement should be organised among the Brahmins and other castes and we hope that in course of time, the relaxation of inter-caste marriage-rules would greatly help in removing the evils of the dowry-system. It was pubicly declared at a meeting recently held in Calcutta by some learned Pundits among whom the names of Mahamahopadhya Pramotha Nath Tarkabhusan and Pundit Smriti Kanta Vachaspati may be mentioned, that no Sastric restriction exists against marriage in another sub-section of

the same caste. The declaration is very important, coming as it does from the Brahmin-Pundits who wield a very great influence on the orthodox Hindu community in matters social, and I sincerely hope that there will now be no hesitation on the part of the members of the different castes in following it.

Let us now see what use is made of the money received in dowries. In a certain number of cases, it is applied to meet the expenses or to pay off debts, incurred at the time of the marriage of daughters in the family. It may sometimes be spent to provide for increased accommodation in the dwelling-house for the married son. If the amount is considerable, it may go to the purchase of Government promissory notes, and in some special cases, it may go to cover the expenses of the education of the son in England. But oftener it is spent in vain shows only. The bridegroom's mother must have street-bands and illuminations for the marriage-procession of her son, but the bride's father must pay for them. The cost of the presents which it is customary to send to the bride from the bride-groom's house on a certain ceremonial occasion *(Gatra-haridra)* before the marriage legitimately falls to the share of the bride-groom's party. The cost has been excessive in recent years, even among the poor middle classes. The well-to-do middle classes who have suddenly risen to affluence are most

extravagant in their expenses on such occasions, and their example proves contagious. The aristocratic families are more reasonable in their conduct and they seldom go beyond the scale sanctioned by long family-practice. But no matter what the cost comes to, it must not touch the pocket of the bridegroom's party, the bride's poor father must bear the whole cost. Relations and friends by hundreds must be entertained by the father of the bridegroom to celebrate the auspicious event, but the cost must be met by the bride's father. Need I multiply other instances of such thoughtless waste of money! Now, to meet all these expenses, exhorbitant dowry in cash is exacted from the bride's father, besides the jewellery to be given to the daughter, the money-value of which is fixed by the bridegroom's party. We, therefore, see that, in most cases, the cash-money obtained as dowry, forms no asset to the family but goes towards the expenses for vain shows only. And if we seriously consider that this is done at the cost of driving many a family to utter destitution, we shall at once see the cruelty and the folly of our iniquitous action and should assert our higher moral nature to put a stop to it.

In order to tackle with the question successfully, the older and the younger generations should both co-operate. I have great faith in the right sense and strength of character of our youngmen. If they are awakened to a sense of

duty in this respect, they will soon be able to put down the practice. Out of respect and modesty, they submit to the iniquitous arrangement of their parents in respect of dowry. The incidents of the last few days have shewn that the conscience of the student-community has been roused in this matter, and they have begun to think that it is improper for them to submit to such unholy contracts. They have realised that they can exercise very great influence in suppressing this pernicious custom, and many of them have taken vows not to submit to a marriage, if there is stipulation of a dowry in it. I sincerely hope that they will stick to their vows. By this, I am not teaching our young men disobedience to their parents. Obedience to parents is one of the noblest traits in the Indian charcter and it must not be permitted to slacken, except under exceptional circumstances. The son may altogether give up his body in executing the command of his parents, but he must not give up his soul, his conscience which is the voice of God within him, for any consideration whatever. We need not apprehend that there would be an irreconcilable breach between parents and sons over this matter. The young men at the age at which they are married ought to be treated as friends by their parents and not as little children.

"पालयेत् पञ्चवर्षाणि दशवर्षाणि ताड़येत्।
प्राप्ते तु षोड़शे वर्षे पुत्र मित्रवदाचरेत्॥

They should be consulted in this the most momentous event of their life and their views on the dowry and other questions must be ascertained. The duty of the parents will be to respect the holy vow taken by the son and to help him in maintaining it, instead of forcing him to break it. If such a reasonable view of the matter is taken by parents, which I have no doubt all sensible persons will do, the prospect of a breach between the father and the son need not be apprehended.

The following are some of the other methods that may be successfully adopted to mitigate the evil. Interest in the matter should be kept alive by holding public meetings for the discussion of the question. If pledges are issued for signature, there should be two kinds of such pledges, one for the young men and the other for their guardians. It will not do to get the pledges signed by young men only; the older generation should be induced to sign them also. This will reduce the chance of friction between parents and sons to a minimum. Many people have got no faith in pledges. Of course, if they are taken only to be broken at convenience, they are certainly worse than useless. But, to my mind, a pledge has got a strong moral force at its back and it has also its educative value. A permanent central committee with an organ of its own should be organised to ventilate the subject and small vigilance committess should

be formed to enquire into the circumstances, as far as possible, of marriages taking place in the community and to report to this central committee all cases of exhorbitant dowry. The central committee should take immediate steps to publicly expose the misconduct of the parties, without any regard to their social position. This will create a strong healthy public opinion against the custom and in time will prove to be an effective check to its growth. Some people suggest social ostracism of the misconducting parties. Such a measure might have been useful a couple of generations ago, but in these days when the old social order has changed, its utility is of doubtful value, and for many cogent reasons, I would not have this system of coercion re-introduced for checking social evils.

Within the short time at my disposal, it has not been possible for me to enter into the detailed consideration of the various side-issues raised in my paper. The questions of Early Marriage and Female Education themselves are too comprehensive to allow me to make more than a passing reference regarding their bearing upon the theme of this paper. As I have stated elsewhere, there are more causes than one which are responsible for the existing deplorable state of things, so that none of the remedies suggested would by itself prove sufficiently strong to counteract the evil ; their collective

action must be brought to bear upon it. I do not pretend to say that I have been able to exhaust the list of the causes of, or the remedies for, the evil. My object in writing this paper is to place before your readers a few suggestions for their careful consideration, and I hope the discussion that will follow will clear up many doubtful points.

The suggestions made in the paper may be summarised as follows :—

I. Public opinion should be educated to raise the social status of our women and no efforts should be spared to give them proper education and training. Their elevated position would prevent their being disposed of in the marriage-maket at a discount.

II. The present standards of selection require modification. In the case of bride-grooms, mere possession of University degrees should not form the basis of selection ; such basis often proves deceptive and disappointing. In their case, general education, character, culture, habits, and family history should mainly determine the selection. In the case of a girl, her general and religious training, the antecedents and moral environment of her family, her accomplishments and her social virtues should guide us in the matter.

III. The compulsory marriage of girls under a certain age should be stopped. No step is of greater importance in checking the evil of the dowry-system than this, and

we must act boldly in this matter, if we are at all sincere in our desire to suppress the evil. We must be prepared to fearlessly face social opposition ; based as it is on ignorance, it is bound to give way in time to the light of knowledge and truth. The advance of the marriage-age of our girls would greatly simplify the question of female education and save the nation from decay by preventing the birth of immature children.

IV. Marriage between sub-sections of each caste should be freely allowed. There are no religious restrictions prohibiting such marriages. The non-observance is due to custom sanctioned by long practice, but there is no reason why it should not be given up to suit the requirements of the modern society. This would amplify the area of selection and would thus considerably weaken the tyranny of the dowry-system.

V. We must curb all unnecessary expenditure in connection with our social ceremonies. I have shown that a greater portion of the dowry is usually mis-spent in getting up vain shows. A strict economy in this matter would, therefore, necessarily effect a reduction in the demands for dowry.

VI. A permanent central committee and a number of small vigilance committees at different centres should be constituted to watch over all marriages, and the misconducting parties should be fearlessly exposed. Pledges

should be signed both by the unmarried young men and their guardians; this has a moral and educative value. Public meetings should be organised to ventilate the question.

VII. Lastly, we should fully assert our higher moral nature if we are really anxious to eradicate this evil from our society. We should drown all selfish considerations and act for the greatest good of the greatest number. We must prove true to the best traditions of our ancient civilisation and to our modern education and culture, which are alike opposed to the the *commercial* conception of marriage.

It is a happy sign of the times that there is a strong unanimity of opinion agaiust the dowry-question among all sections of our community. In almost all questions of social reform, there is a certain section of the orthodox community which would oppose the movement, if not for anything else, for the sake of opposition only. In regard to the present question, however, the combination against the evil is general, and our earnest prayer to Heaven is that it may prove to be a successful combination.

My best thanks are due to Prof. Hem Chandra Dey, M.A., of the Bethune College for help in the preparation of the paper.

Professional Beggary in Calcutta.*

दरिद्रान् भर कौन्तेय मा प्रयच्छेश्वरे धनं ।
व्याधित स्यौषधं पथ्यं नीरुजस्य किमौषधैः ॥

Help the poor, O son of Kunti; do not abuse charity by helping those that have plenty. The sick only need medicine; what will medicine do for those that enjoy good health?

As this question is now engaging the attention of the Corporation of Calcutta and the Government of Bengal, I lay before your readers a few suggestions which might be found useful in the solution of this difficult social problem.

In the present communication, I shall confine my remarks to Indian beggars only. They may be broadly divided into the three following classes :—

A. *Street beggars.*

B. *House to house beggars.*

C. *Distressed bhadraloke beggars.*

As an old resident of Calcutta and being in close touch with some of the charitable organisations of this city for distribution of

* The Modern Review, April, 1919.

relief among the poor, I am convinced that begging has generally been on the increase, and that the nuisance of beggars in the streets of Calcutta has grown to a serious extent.

A. **Street-beggars.**—The *street-beggars* generally consist of infirm, old and diseased persons and boys and girls of tender age, who station themselves at prominent places in the streets, generally at the tramway junctions, the bathing ghats, the market-places, temples and mosques, where people usually congregate in their daily business. Some of the beggars beg for themselves; others (mostly the crippled ones and the children) are placed there by people who profit by their earnings. Among them are also found able-bodied persons some of whom are religious mendicants. Lepers and persons suffering from filthy and contagious diseases are to be found among them in large number and this must be considered as a source of great danger to public health.

B. **House to house beggars.**—This class includes religious mendicants, the aged and the infirm poor, and also some professional beggars.

C. **Distressed bhadraloke beggars.**—Owing to hard economic conditions, distress among the respectable poor is increasing. The daily growing number of applications for relief from this class of people to the several charitable institutions of this city, go to confirm

the above observation. The breaking down of some of the old Hindu social institutions, such as the *joint family system* &c., is to a large extent, responsible for this state of things.

Remedies Suggested.—I am of opinion that we need not at present take into our consideration the case of beggars included in classes "B" and "C", for the simple reason that they do not constitute a public nuisance in the sense that the class "A" is. Our efforts should for the present be directed to minimise the nuisance of *street begging*.

The existing law in force (Police Act, Sec. 70 and 70A) is quite capable of dealing with this evil, and in my opinion, the law need not be made more stringent. The reason why the law can not be effectively enforced is because there is at present no place where all the old, infirm and incurably diseased beggars (when they are taken before Magistrates) could be sent. The Magistrates are after all human beings and they can hardly be expected to take so hard a line as to send these people to jail, for the simple reason that they have to stick to begging because they can not earn their living in any other way. Eighty percent of the beggars are, therefore, simply warned and discharged by the Magistrates, and it is no wonder that the existing law exercises no deterrent influence on the evil practice.

The real remedy to stop this evil lies in the establishment of an institution where the aged, the infirm and the incurably diseased beggars could be sent by Magistrates and sheltered and taken care of. Temporary provision may be made for the admission of these people in some of the existing institutions in the city until a new Home is organised and started outside the city for their accomodation. An *infirmary* and an *industrial school* should be attached to this institution for reasons to be explained later on.

To carry out the above, the approximate number of *street-beggars* of this class in Calcutta should be ascertained, so that adequate provision may be made in the new Home for the requisite number.

All lepers found begging in the streets should be detained in a leper asylum. The Police has power under the Act to do this at once.

All beggars suffering from infectious and other diseases should be sent to the *infirmary* attached to the Home for treatment, and when discharged cured, they should be helped with suitable work by an organisation to which a brief reference will presently be made.

The cost of the maintenance of this Home should be borne jointly by Government and the Corporation of Calcutta, aided by subscriptions raised from the charitably disposed public. The

Poor box Fund at the disposal of the City Magistrates should be applied for the maintenance of the Home.

In dealing with the class of beggars under head "B", it must not be forgotten that with the Indians, the giving of alms to mendicants and *fakirs*, who under a vow depend upon this form of charity for their livelihood, is considered to be a part of their daily religious duties. It is well known that on occasions of special social and religious ceremonies, beggars are sought for and are fed or given sweets, money and clothes at the houses of both Hindus and Mahommedans. Such social customs enable this class of beggars to get a sufficiency of food and raiments for the ordinary requirements of life, and they have, therefore, no excuse to betake to *street-begging*. I would not, therefore, interfere with these people as long as they resort to strictly legitimate quarters for the begging of alms, but any religious mendicant found begging in the streets of Calcutta should be brought under the operation of the law. The *house to house begging* and *begging* within the grounds of temples, mosques and other places of worship are open to them and they have no excuse to create nuisance in public thoroughfares.

I am, therefore, of opinion that the system of *house to house begging* need not at present be interfered with. It is sanctioned by religious usages and is in accord with the traditional

sentiments of the people. It forms an outlet for individual charity to relieve distress among the poor and the helpless of the community. There is no doubt that some professional beggars take advantage of this system but it cannot be helped.

In the case of the *able-bodied street-beggars*, it cannot, however, be denied that although as a class, they are the least deserving of sympathy, yet, even among them, a certain percentage (no doubt a small one) beg from sheer necessity. New arrivals in Calcutta who find themselves stranded in the streets in the absence of friends or relations, men suddenly losing their employments, &c., often find it too difficult to get a living for themselves and their dependants for the time being, and are compelled to take to *street-begging*. For these, I would suggest that there should be some organisation whence they can obtain temporary help on application in the shape of money or rations in lieu of some kind of work demanded of them. An institution on the line of a *Work-house* may be established where they could work and earn their daily bread until they can get suitable employment elsewhere. Without some such provision, it would not be fair to punish people for begging when they are unable to find work to earn their living.

Arrangements may also be made with many of the charitable institutions in the city to provide temporary help in such cases.

All able-bodied beggars not falling within the above categories, and any person refusing to submit to the above conditions, should after proper enquiry be dealt with strictly in accordance with the terms of the existing law. Repeated punishment will, I feel convinced, have a deterrent effect on the present evil practice.

The relief of the *distressed bhadraloke beggars* must be left to private charity and to the institutions for distribution of organised charity existing in the city. Such charities should be made reproductive as far as possible, and with this object, they should be associated with departments of some common industries and handicrafts so that any person receiving help will have an opportunity of giving some thing in return and be thus saved from humiliation and loss of self-respect inseparable from begging. It is a complex sociological problem which has always taxed the time, energy and resources of people of all countries and communities for a satisfactory solution.

The number of juvenile beggars in the streets of Calcutta is on the increase and this constitutes a great nuisance and a source of danger to the public. For not only these children give trouble by begging in the streets but they swell up the criminal population of the city as pick-pockets and thieves. I would suggest that they should, by orders

of magistrates, be put in the industrial school to be attached to the Home already referred to, unless their natural guardians, if they have any, stand security for them against repetition of the offence. They should be detained in the school for such time as would be required for a thorough training in some useful art or industry which would enable them to obtain a decent living on their discharge from the school.

Although the present paper deals with the problem as it affects Calcutta, the subject is of general interest, as all large cities in India more or less suffer from a similar nuisance, and they may be called upon any day to devise measures for its suppression.

Calcutta Suppression of the Immoral Traffic Bill *

The extent to which commercialised vice prevails in this city and the amount of misery, moral degradation, disease and destitution which follow in its train are matters of common knowledge and I do not wish to take up the space of the Review by making a detailed reference to them. Suffice it to say that the number of women who earn a living by prostitution has considerably increased in Calcutta during recent years and that about 1200 minor girls are annually imported into this city for immoral purposes. According to recent calculations, there are now about 39000 such unfortunate women in Calcutta. Further, a great many disorderly houses have been planted within the last few years in the heart of respectable quarters in the city to the great annoyance, inconvenience and moral danger of the residents of these localities.

It is a matter for sincere congratulation that a strong public opinion is growing up in this city demanding more stringent measures

* The Modern Review, September, 1923.

than are at present in vogue to check the progress of the evil; and the present Bill, I am glad to say, is the outcome of such public opinion. It is true that vice cannot be planted out by legislation only; there are a great many important factors, social and economic, which contribute to the growth and maintenance of a vice of this kind in a community and the causes must be sought out and removed before one could expect to see the vice rooted out. At the same time, it must be admitted that legislation can do a great deal in providing adequate safeguards and protection against helpless women and minor girls being led into a career of vice. The law, as it at present stands, is not strong enough to effectively deal with this difficult problem. There are many loopholes and weak points in the exisling law which are being taken advantage of by people engaged in immoral traffic in this city. Hence the necessity for the present Bill in which penalties for offences have been enhanced and increased powers are proposed to be given to the authorities for the effectual suppression of the evil. All friends of civic purity will feel grateful to the Bengal Christian Conference, the Bengal Social Service League and the Indian Christian Association for convening public meetings of the citizens of Calcutta for a full discussion of the principles involved in the present Bill and for giving the weight of their moral support to it.

Those who consider the Bill to be a piece of drastic legislation and take exception to the increased powers proposed to be given to the Police in the Bill, should take into their consideration the enormous gravity of the offence involved in the *immoral traffic of minor girls* and the far-reaching evil consequences—social, physical and moral, resulting therefrom; and from this point of view alone, I am sure one would have little hesitation to acknowledge that the Bill, instead of being a piece of drastic legislation, does not go far enough, and that if it has erred at all, it has erred more on the side of leniency than on the side of severity. In this connection, I would ask the readers to go carefully through the interesting small pamphlet which has been issued by the Calcutta Vigilance Association fully explaining the object and scope of the Bill and dealing with its various aspects and answering some of the criticisms levelled against it. I am sure, the perusal of the publication will not fail to convince any right-thinking person that the Bill fully deserves his sympathy and support. A copy of the publication may be had from Mr. F. E. James, O. B. E., Hony. Secretary, Calcutta Vigilance Association, 25, Chowringhee Road, Calcutta.

Answers to the above questions have heen given in this pamphlet and I would quote them here for the information of your readers :—

"*Objection No. 2. The Bill is too drastic,*

A careful perusal of the Bill will convince the reader that this is not the case. The penalties for solicitation and brothel-keeping are less severe than those which exist in Rangoon and Colombo at the present time, and they are also less severe than the measures which have been recently recommended in the report of the Prostitution Committee appointed by the Government of Bombay.

"*Objection No. 3. The bill gives too much power to the Police.*

This is a very general objection and must be fairly met. The following points are to be noticed :—

I. The additional powers given to the police are not very very great and deal with (*i*) public solicitation, (*ii*) keeping of brothels, (*iii*) protection of minors. THERE ARE MANY SAFEGUARDS PROVIDED in the Bill, *e. g.*,—

(*a*) No power of arrest is given to any police officer below the rank of Sub-Inspector.

(*b*) Only those officers especially empowered by the Commissioner of Police are given power to arrest. They will be selected men, duly authorised to deal, probably, with particular cases or localities.

(*c*) Any order which is passed by the Deputy Commissioner of Police is subject to confirmation by the Commissioner of Police.

(*d*) No officer BELOW THE RANK OF INSPECTOR AND NOT ESPECIALLY AUTHORISED IN WRITING by the Commissioner or Deputy Commissioner of Police can enter a brothel for the purpose of removing therefrom a girl who is reported to be under 16 years age. Before any order can be passed concerning such a girl, the case must be considered in the Juvenile Court according to the provisions of the Bengal Children Act.

II. After all, the Police are the authorised guardians of the law and in attempting to stop the exploitation of women and girls for immoral purposes, they must have adequate power. At present, they are heavily handicapped and social reformers in Calcutta have had their work hindered many times, because the police have no power to act in certain cases. Moreover, if the police are not given the power, TO WHOM CAN THE POWER BE GIVEN ?

III. Experience has generally shown that in these matters, the police only act in specific cases at the suggestion of public bodies or private individuals who are interested in this question. It would be excellent to have a Vigilance or Watch Committee representing respectable citizens in every ward of the city, to aid the police in keeping the city clean."

There is an important and regrettable omission in the Bill. It has made no provision to deal with *procurers* who are the principal actors in the immoral traffic of girls and who should be very severely dealt with by the law. A clause covering this point was included in the original draft of the Bill but it has been inadvertently left out of the Bill as it now stands. With reference to this point, the remarks of the Calcutta League of Women Workers are quoted below :—

"It is considered that a very grave omission consists in the fact that no reference is made anywhere, from beginning to end of the Bill, to that class of person called the "procurer." It is strongly urged that a clause dealing with this type of offender may be inserted, and not merely a reference made to the subject in the statement of objects and reasons. The League is of opinion that the severest penalties in the hands of the law should be adopted in dealing with this class of person, who is almost entirely responsible for the supply of women and girls to brothels in Calcutta. It is considered that imprisonment, transportation and, in some cases, corporal punishment, should be resorted to as the only effectual deterrent, and that, in no case, should the option of a fine be allowed."

We are glad to note that steps have been taken to have this mistake rectified at the time when the Bill is considered by the Select Committee to whom it has been referred by the Legislative Council without a single dissentient voice.

There are two aspects of the question dealt with in the Bill to which I would particularly

draw the attention of your readers. The one refers to the *protection of minor girls*, and the other, to the *control of brothels and disorderly houses*. It is most sad to reflect that thousands of innocent girls are being sacrificed annually in this city for purposes of gain and gratification of lust and that the existing law and public opinion are entirely helpless to stop the evil. Every good citizen of Calcutta is, therefore, in duty bound to see that this cruel and abominable trade is put down with a strong hand.

In this connection, it may be noted that the absence of a Home where girls rescued from houses of ill fame could be taken care of, is very keenly felt in this city. There are a few Christian institutions in Calcutta which give shelter to such girls and impart to them a suitable education and training to enable them to earn an honest livelihood. But the limit of accommodation in such institutions is very inadequate and the Indian public are not well-disposed towards them on religious grounds. I may be permitted to mention one Indian institution which deals with such girls and with which I am connected. Within the last fifteen or twenty years, this institution for Hindu orphan children has undertaken the charge of 40 girls under 10 years of age, all removed by the Police from houses of ill fame in Calcutta. Of these, seventeen have been married to suitable parties, many of whom are now mothers of children and are living happy lives in their new homes. The rest are still inmates

of the institution and are getting proper education and training under our care. But our accommodation is extremely limited and under our rules, we cannot take girls above 10 years of age and they must be of Hindu parentage only. This problem of immoral traffic in girls in Calcutta cannot be satisfactorily solved without the establishment of proper Homes for their shelter and education. It must be stated with regret that owing to the rigid social customs of the people, these girls cannot be taken back to their families, even if they are found pure and innocent. I would, therefore, most earnestly appeal to Government and to the leaders of the different communities living in Calcutta, to do their best to get up suitable Homes as early as possible for the shelter and education of girls rescued from houses of ill fame.

The very appropriate and forceful observations of the Calcutta League of Women Workers on the question of suitable Homes for the reception of girls saved from a life of shame may be cited below :—

"The League considers that the Bill is incomplete without provision being made for a house of detention to which girls may be removed. It is further thought desirable that any girl removed in this way should be brought before a small committee of sympathetic women for a thorough investigation of the case. Any such home should be managed by a committee of women who would appoint a thoroughly

efficient woman superintendent to carry out their instructions. The League further considers that there should be one home for children of tender age, say below ten and another for girls above that age. The League has recently had under consideration a scheme for the establishment of rescue-homes for children, but it is felt that this scheme being of a purely private nature will be quite inadequate to meet existing needs without the support of the Government."

As regards control of brothels and disorderly houses, the case of Joy Mitter Street may be cited as a flagrant instance of the helplessness of the existing law to prevent location of new brothels among decent people in the respectable quarters of the city and on the main thoroughfares. The history of the case is very interesting. In 1920, a brothel was opened in Joy Mitter Street. The respectable residents of the locality tried their level best by all lawful means for the removal of the brothel but without success, simply because the law is defective, there being, in the words of the Magistrate, "*unfortunately no law by virtue of which women of ill fame can be prevented from buying or building houses for themselves in localities inhabited by decent people.*" It may be noted here that the present Bill, if passed into law, will remedy the evil.

Similar complaints have been made from time to time by the respectable residents of

Raja Harendra Krishna lane in Ward No. I without any redress. There is a big school facing this lane which has been standing there for more than half a century. It is very desirable that this lane should be made clean in the interest of the school and of the respectable families residing in the locality.

There is another very important point to consider in respect of this Bill. Calcutta is a great educational centre. Thousands of young men flock to this city from all parts of Bengal to receive their school and college education. They are thus removed, for the time being, from the care and supervision of their parents and guardians and from all the healthy and good influences of home. In the interest of the student community of Calcutta, the city should be made as clean as possible, so that our young men may be kept at a safe distance from the sight and infection of this vice.

All religions, Hindu, Mahommedan and Christian, condemn prostitution. It is forcefully interdicted in the Bible. *Manu*, the great Lawgiver of the Hindus, strongly deprecates the association of the higher castes with prostitutes, which bars their passage to the higher worlds. The *Quoran* prescribes a violent death to an adultress.

It may be interesting to know the position occupied by public women under Hindu and Mahommedan kings. *Kowtilya*, the great

author of the *Artha Shastra,* assigns to prostitutes an out-of-the-way corner in towns or villages. We read in the *Ain-i-Akbari* that in the reign of Akbar, all prostitutes used to be located in a special quarter of the capital which was called the *Shaitan-pur* or Devil's Quarter which was put in charge of a Darogah. A register was kept in his office in which any person wishing to visit a prostitute must sign his name. I wish some such provision has been made in the Bill now under the consideration of the Bengal Legislative Council. Further, any person wishing to take a dancing girl to his private house had to take the permission of the officer in charge of the Devil's Quarter.

According to Manucci, the great Italian traveller, these rules were very much relaxed during the reign of Shajehan and the prostitutes enjoyed unbridled liberty. But as soon as Aurangzeb ascended the throne, he passed a decree ordering that those prostitutes who would enter into a married life would be allowed to remain in the capital and the rest expelled from it.

It thus appears that public women used to be segregated and they possessed separate quarters of their own under Hindu and Mahommedan kings. Such an arrangement greatly helps to keep a city clean. There is no reason why in the interest of public morality, the same arrangement cannot be introduced into our own city and the educational,

residential and business quarters of the town kept clean and free from the encroachment of these undesirable people.

In conclusion, let me state in the words of the Calcutta Vigilance Association that though the Bill is not perfect and is susceptible of great improvement, its general principles constitute a great advance upon the present conditions and *deserve the support of all who care for the welfare of their city.**

* The Bill has since been passed into law: The Calcutta Vigilance Association is making arrangements for starting a Home in the vicinity of Calcutta for accommodating minor girls rescued by Police from houses of ill fame.—*EDITOR.*

END OF VOLUME II.

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